NOVEMBER/DECEMBER 1981 $3.00

Classroom Computer News

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"Don't bother me, I'm learning."

The joy of learning: there's nothing more rewarding than helping a child discover it. That's the most important reason behind the explosive growth of computers in the classroom. The coming of the microcomputer—compact, affordable, easy-to-operate—has made it possible. But the expanding use of the computer as an educational tool owes its momentum to the enthusiasm of involved teachers. Teachers who have experienced dramatic results, in human terms.

They've seen that the computer can help any child reach full potential. By challenging, by stimulating, by allowing fast and slow students alike to learn at their own pace. They've also seen in the computer an opportunity for their own professional growth.

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Watch local TV listings for "Don't bother me, I'm learning," a documentary special on computers in education produced by One Pass Video and sponsored by ComputerLand. Or call us and ask about a private screening of this intriguing film. It will be available to groups and individuals for viewing at ComputerLand stores or a location of your choice.

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Forum

A National Tragedy Is Taking Shape

by Ludwig Braun

I am not a political person, and I'm certain that I am not intelligent enough to make decisions about national policies and national priorities. I *am*, however, intelligent enough to know that our most precious national resource is the minds of our children—not tungsten, oil, nuclear weapons or chemical plants, but *kids*!

The Germans, Japanese and Russians all realize this and have massive national programs in place to increase the intellectual levels of their high school graduates. We need only compare the fractions of young people taking science and mathematics courses and the depth of coverage in U.S. schools with those in other countries to see our national future going down the drain. At a time in history when society is becoming more and more technologically oriented, our young people are less and less well prepared to contribute in these new directions.

Rather than rising to this challenge, or even just acknowledging its existence, the Reagan administration is busily dismantling the only group in the federal government that has the capability to address this crisis. The administration has cut significantly the science education component of the current budget of the National Science Foundation, has decimated it in the 1982 budget and plans to phase out science education totally by 1983.

NSF was given the responsibility for science education in response to Sputnik, a Russian achievement that assaulted our national honor. For some unfathomable reason, in response to an assault on our national *survival*, the Reagan administration is dismantling that same mechanism.

This tragedy is most evident to me in the area of computers in education. Efforts to convince educators that computers have the potential to do remarkable things in the learning experiences of kids have begun to pay off dramatically in the last two years. The number of microcomputers in schools now is certainly measured in the hundreds of thousands.

Unfortunately, all these computers need large numbers of trained teachers and substantial efforts to integrate them into existing curricula as well as to identify new applications. Such efforts are very unlikely to develop locally or even at the state level. Federal support and involvement are essential to the successful addressing of these needs.

Why is this tragedy permitted to occur? I can only conclude that within the present bookkeeping mentality in Washington, items to be eliminated from the budget are chosen on the basis of two criteria: (1) the balancing of columns of figures without regard to short- or long-range impacts of cuts and (2) the perceived weakness of the affected constituencies. Since youngsters are a weak constituency, education funds are easy to cut—even though the sums involved are small compared to the round-off error in our defense budget. (For the cost of one nuclear-powered aircraft carrier, we can put approximately 50 microcomputers in every school in the U.S.)

In my opinion, it is disgraceful that educators and parents haven't formed a lobby to fight for funds to improve the education of our kids. We all must write to our representatives in Congress and to President Reagan urging reconsideration of these cuts and underscoring the fact that there isn't a better way to ensure the future strength of our country than to invest in our children. □

Dr. Ludwig Braun is director of the Laboratory for Personal Computers in Education, State University of New York at Stony Brook.

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Departments

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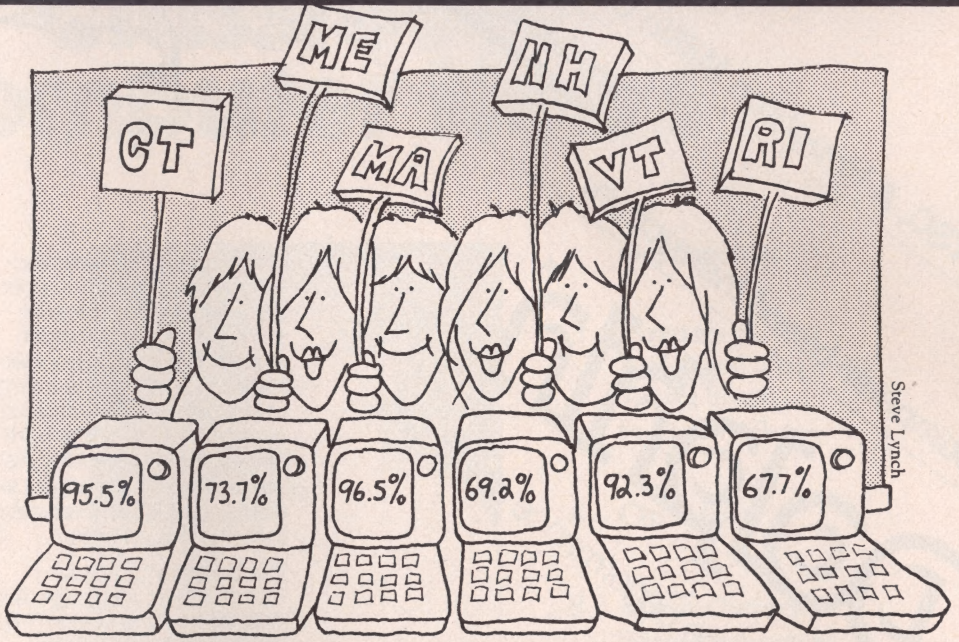
On Line



Percentage of schools in each state reporting microcomputer use

Data for the "Use of Computers in Education" survey were analyzed by the Addison-Wesley Publishing Co., Reading, Mass.

Survey Reports on Computer Use in New England Schools

If you were a computer-using student in New England, chances are you'd live in Massachusetts and work on a TRS-80 microcomputer in your high-school math or computer science class. Such was the profile that emerged from a state-by-state survey of computer use in New England schools conducted by The Research Special Interest Group at Lesley College, Cambridge, Mass.

Emily S. Steinberg and Sheila M. Astuccio, both graduate students at Lesley College, report that the Fall 1980 "Use of Computers in Education" survey sought to understand the impact of computers on public school education in New England. They mailed surveys to all public school districts in the six New England states and received 226 responses. Some of the survey findings were:

- Massachusetts school districts lead the other New England states in the use of computers in the classroom. In the sample of Massachusetts districts, 96.5 percent indicated use of computers as compared to the lowest percent (67.7) from Rhode Island.
- Of a total of 1565 computers/terminals reported in use, 1094 were located in high schools, 277 in junior high schools and 194 in elementary schools. Computers were most often used in high-school computer science or math classes. Twenty-one percent of the high schools, 10.1 percent of the junior highs and 4.8 percent of the grade schools report after-school computer clubs.
- The most widely used microcomputer reported was the Radio Shack TRS-80; the Digital PDP-8 and PDP-11 were the most widely used minicomputers.
- BASIC and BASIC PLUS are the most commonly available and used computer languages, with FORTRAN and COBOL also widely noted.
- Overall, 66.7 percent of the respondents anticipate having more computer facilities in the near future. The highest potential for increased facilities exists in Maine and Vermont.

LOGO News

LOGO, the much-heralded, child-oriented computer language, sailed into commercial production some months ago, churning up an expected froth of interest and activity. Now a free software catalog and a newsletter are available to LOGO users.

Microcomputers Corporation's new, free LOGO software catalog lists 300-400 LOGO programs, some of which are educational and all of which will run on a Texas Instruments TI-99/4A computer equipped with a special LOGO interface. Each catalog listing contains a short description of the program, contact information, classification by application and price. Texas Instruments; Scott, Foresman and Co.; Microcomputers Corporation and several other companies have developed the listed software.

Microcomputers Corporation has also initiated a free, bimonthly newsletter called *TI LOGO SOURCE* that reports the latest LOGO developments and reviews new LOGO procedures. The newsletter will become a forum for a "softswap" of LOGO procedures among readers. Interested readers who don't have their own procedures to swap will be able to purchase those listed at a nominal cost (usually the cost of just a cassette or tape or the printing costs for paper).

TI LOGO SOURCE is a companion publication to *TI SOURCE*, another free, bimonthly publication of Microcomputers Corporation. For further information, write Microcomputers Corporation, P.O. Box 191, Rye, NY 10580; 914/967-8370.

On Line

Information, Please

Free access to information banks is presently available from over 100 small computers across the country. Among the operators of these databases are publishers, schools, user groups, commercial businesses and hobbyists who want to relay information they have obtained on subjects ranging from medicine to photography.

These databases may be accessed through any telephone by using a modem, a device used to receive computer signals over a telephone line, hooked up to a computer or terminal. Modems generally sell for under $200. The user dials a telephone number, places the phone receiver into the modem, enters a designated password and begins working.

Novation, Inc., a manufacturer of data communications hardware, offers a 24-hour a day free directory of computer-based information banks. For access to this directory, place the phone receiver into the modem and dial 213/881-6880. When LOGAN PLEASE appears on your computer screen, enter the word CAT. The list of dial-up computers will be displayed as item 18 of an 18-item menu.

For further information contact Novation, Inc., 18664 Oxnard Street, Tarzana, CA 91356; 213/996-5060.

Atari — Coming on Strong

Atari, a late-comer to the microcomputing field (their first computer was marketed in 1979), has recently made several strong and successful bids for prominence in the educational computing market. Heading the list is a recently announced agreement with the Minnesota Educational Computing Consortium, one of the oldest and most respected educational computing organizations in the country.

According to MECC's Director of User Services Ken Brumbaugh, the decision to purchase Atari computers came after a seven-month survey of computing needs in Minnesota. The state plans to use its Atari's as a low-cost way of extending its computer network, which allows computers throughout the state to communicate with one another over the telephone lines.

MECC will also translate approximately 75 of its programs, currently available for Apple computers, for the Atari. They hope to have the programs available by next February. Brumbaugh says that use of the Atari in Minnesota will supplement, not replace, use of the Apple, which is the machine MECC has traditionally supported. In addition to MECC, the Dade County, Florida; Fairfax, Virginia; and Cupertino, California, schools have all awarded large contracts to Atari.

Also underscoring Atari's commitment to the education market is the formation of the Atari Institute for Educational Action Research. The Institute hopes to foster the innovative, yet practical, use of computers in education through grants of Atari computer products and/or cash stipends to selected institutions, individuals or organizations. Grants totaling over $250,000 in cash and equipment will be awarded during the institute's first year of operation. They will go to projects that promulgate new uses for computers in education, whether that usage takes place in established institutions, in community programs or in the home.

According to Chris Bowman, Atari's national marketing manager for education, Atari's two primary targets are the education and home markets. "Obviously, half the total energy of the company will go to the education market," he says. In five years, "Atari expects to be a major force in the educational use of computers.

Authors Wanted

Papers to be considered for publication in the National Council of Teachers of Mathematics 1984 Yearbook are being requested by the Yearbook Committee. Viggo Hansen, California State University at Northridge, is the issue editor. The theme of the Yearbook is the impact of technology on mathematics teaching and learning. Computers, calculators, video cassettes, video discs and related technology will be addressed. The focus of the Yearbook, however, will be goals, content and methods of instruction rather than hardware.

Proposals for papers must be received by March 1, 1982. Guidelines for writers, including instructions for preparing proposals, are available from Marilyn Zweng, General Yearbook Editor, N-297 Lindquist Center, University of Iowa, Iowa City, IA 52242.

Math/Science

Science Education: A Bibliography

by Wilbur Parrott

Bork, Alfred. "Computer Graphics in Learning." *Journal of College Science Teaching*, January 1980, 9(3): 141-149.

Reports on a three-year program at the Educational Technology Center of the University of California, Irvine. The program formulated computer-based beginning physics courses that gave students options that would be difficult or unavailable in a normal physics program. It also developed computer dialogs, called "controllable worlds," that gave students more control in operating the program.

Cox, Dorothy and Berger, Carl F. "Microcomputers Are Motivating." *Science and Children*, September 1981, 19(1): 28-29.

The authors relate personal experiences with seventh- and eighth-grade science students. Motivation and group interaction are major emphases.

Faughn, Jerry and Kuhn, Karl. "Computer Tutorial Programs in Physics." *The Physics Teacher*, December 1979, 17(9): 598.

Reports on two sets of 30 tutorials for calculus-based and algebra-trig.-based introductory physics courses. The programs, available in DECAL (DEC's author language), were developed with National Science Foundation support and are available for purchase.

Gallardo, Julio and Delgado, Steven. *Programs for Fundamentals of Chemistry*. May 1977. ERIC Document No. ED 141 139.

Presents programs written in BASIC PLUS that teach remedial or fundamental college chemistry. The article includes instructions for each program, plus separate practice sessions on subjects including decimals, mathematical operations, metric conversion, solving proportions, balancing chemical equations, gas laws and solutions.

Gawronski, Jane Donnelly, Henrickson, John and Fehler, Joan. "Computer-Assisted Instruction in the Elementary School." *School Science and Mathematics*, February 1976, 76(2): 107-109.

Reports on multimedia approach (print, filmstrips, videotape) for teaching use of the terminal and some BASIC statements.

Grier, James W. "Ecology: A Simulation Model for Small Populations of Animals." *Creative Computing*, July 1980, 6(7): 116-121.

This program uses BASIC's random function to solve the problem of mathematical models that are too restrictive to be of much use or too simple to be realistic. It can be used for real applications or instructions, or as a game.

Kiltinen, John O. and Turino, F. Walter. "Computer Applications in the Classroom; A Case Study: The Wheatstone Bridge." *School Science and Mathematics*, December 1977, 77(8): 675-680.

This article uses a simulation of the "Wheatstone Bridge," a piece of equipment in the physics lab, to familiarize teachers with simulation as one type of computer application. The author will provide a printout of the program.

Kraft, Nancy. "Lab Assistant." *Classroom Computer News*, September/October 1980, 1(1): 18-19.

The article offers both hardware and software designs for simple elementary school-level science experiments for the Apple microcomputer.

McNeill, Arthur L. "Ideal-Gas Law." *Compute!*, June 1981, 3(6): 52-57.

Given three of the four variables needed to determine the quantity of a gas, this program solves for the fourth. A menu enables the user to choose which value to determine and whether the problem should be solved in scientific or engineering units.

Mancock, John F., Jameson, A. Keith, Jameson, Cynthia J. and Settle, Frank A., Jr. *Chemical Equilibrium*. ERIC Document Nos. ED 182 119, ED 182 120, ED 182 121, ED 182 122, & ED 182 123.

This set of undergraduate chemistry units on chemical equilibrium includes a student's guide, a teacher's guide and copies of sample runs for each unit. Also includes program listings in BASIC.

Moore, John W. and Moore, Elizabeth A. "Computer Simulation." *The Science Teacher*, March 1977, 44(3): 33-34.

This article discusses the simulation approach for *The Limits to Growth* and two other futurist studies.

O'Neil, David. "Physics Teacher." *Microcomputing*, June 1980, Number 42: 138-148.

The article describes and lists 13 programs for high school physics.

Orlove, Michael. "Wasps and the Impossible Elevator." *Creative Computing*, October 1981, 7(10): 178-182.

The two genetics programs described introduce the concepts of "altruism" genes and "selfishness" genes ("Wasps") and of evolutionary genetics ("The Impossible Elevator").

Rosen, Allen I. "A Computer-Oriented Course In High School Physics." *The Science Teacher*, June 1975, 42(6):18.

Math/Science

In this high school physics course students write their own BASIC programs to analyze problems. They must thoroughly understand the physics problem and analyze it logically in order to write the program. The course uses both computer-assisted and computer-managed instruction.

Rowe, Mary Budd, ed. *What Research Says to the Science Teacher, Volume 2.* 1979. ERIC Document No. 166 057.

Computers in science education is one of the areas explored in this volume of six papers concerning research areas in science education and their implications for classroom teaching.

Segar, Bryce. "Hurricane!" *Microcomputing*, October 1979, Number 34:84-86.

This program monitors the track and distance of an approaching hurricane (real or imagined). The user provides the latitude and longitude of his or her town and of the hurricane, as well as the hurricane's speed and direction.

Stavrides, Marie K. "Computing Days." *Science and Children*, September 1978, 16(1):18-19.

A third-grade teacher reports on her experience developing a computer literacy program involving students, teachers and parents.

Szabo, Michael. *Science Education and Computer-Managed Instruction: The State of the Art.* February 1976. ERIC Document No. ED 135 599.

This review of the uses of computer-managed instruction documents systems for science and other subjects.

Tinker, Robert F. "Microcomputers in the Teaching Lab." *The Physics Teacher*, February 1981, 19(2): 94-105.

The author reviews hardware considerations and applications for computers in the science lab.

Tinker, Robert and Tim Barclay. "Computers in the Science Lab." *Classroom Computer News*, September/October 1981, 2(1); 22-23.

Explores the often overlooked uses of microcomputers as science laboratory tools.

Windbigler, Jerrol. "Individualizing Chemistry with a Computer." *The Science Teacher*, January 1978, 45(1):24-25.

The author shares seven steps for designing computer programs that process lab data and provide individual student assignments. □

Wilbur Parrott is coordinator of elementary libraries for the West Bridgewater Public Schools, West Bridgewater, Mass.

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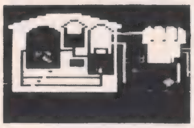

Here is an educational simulation in a game format that is sure to help illustrate and dramatize your discussions of nuclear power topics in general science, physics, political science, history, ecology, and even management and economics classes. Let your students decide whether or not nuclear technology is too complex to handle. They must manage the facility and supply electricity profitably—or lose their license to operate. But sloppy operation or pushing too hard may cause a radiation leak . . . or worse!

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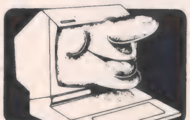

Use this program to verbally enhance any educational programs you may already be using—or planning to write. You can give your Apple the power of speech without employing any additional hardware . . . simply by applying The Voice program. The benefits are obvious for students with low reading skills or impaired vision or speech.

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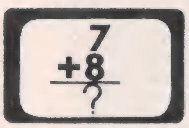

This program contains interactive lessons designed to help teach elementary addition, subtraction, multiplication and division on nine skill levels. Extensive color graphics and computer voice help maintain student interest and reinforce concepts . . . Self-demonstrating, too, so that you can spend more time in actual teaching while the program manages drill and practice.

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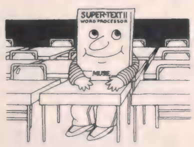

Here is an all-purpose text editing program which will prove invaluable in so many areas: grading, lesson-planning, journalism and yearbook classes, English composition, and just plain personal use in filing, manuscript and report generation, and everyday correspondence. You will not believe how much money your school or department can save with this program . . . not to mention drudgery!

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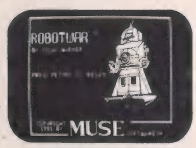

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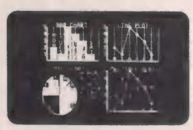

If you're a department head or an administrator, or if you want to keep better progress charts on your students, then Data Plot is for you. Easy editing allows you to create and modify a wide variety of graphic representations of numerical information. Basic statistics are displayed automatically.

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THE TIME-SHARE PENCIL

A fantasy for our times by Jack Turner

After learning recently of a classroom in India that has only one pencil for 30 students, I considered the parallels implied for microcomputers in American schools. To provide a new perspective on the problems and prospects of accommodating to computer use in education, I have invented a fantasy. Johann Pestalozzi (1746-1827), a forward-looking Swiss educator, has just received a response from the School Committee regarding his request for classroom sets of pencils. Although pencils as we know them had been developed by 1565, these tools did not become commonly available until about 1800: technological advances were rapidly lowering the price per unit.

TO: Johann Pestalozzi, Headmaster

FROM: School Finance Committee

RE: Your Request for Student Pencils

We must regretfully respond that your request is denied. After careful consideration of your unprecedented proposal to provide each student with a pencil, the Committee has elected to purchase only one such unit for use in your classroom. The rationale for the Committee decision is enumerated below, followed by queries to which you must respond (triplicate) after field-testing the pencil.

A. Pencils are fragile and break down easily owing to primitive technology.
B. Acquisition of pencils in quantity leads inevitably to requests for other expensive peripherals such as sharpeners, erasers, tablets, etc.
C. We cannot justify the expenditures for these systems to patrons whose education was perceived as adequate without any such paraphernalia.
D. The Committee expressed doubt that students would use the requested pencils for activities more substantial than doodling or tic-tac-toe.
E. We strongly suggest you reconsider your proposal to allow students to use pencils to work ciphers and related mathematics. Apart from the loss of requisite mental rigor implied by your position, what will happen if students become dependent on pencils to solve problems but cannot locate such in time of need?
F. Appropriate usage of pencils presumes teachers who know how to incorporate them into classroom activities. Yet very few teachers have such skills; thus pencils would probably be relegated to storerooms.

Within two weeks of the close of the annual school session the Committee would like to receive your answers to the following questions:
A. Does the requested apparatus have applications in schooling beyond the working of ciphers?
B. Do you recommend the creation of a new discipline of pencil literacy? If so, which of the present legitimate disciplines should be dropped in order to accommodate the new course?
C. Is this "new tool" (as described by you) especially useful for specific sub-groups of students, e.g. the particularly dull or perhaps the brightest?
D. Do students from rich families having pencils in the home distance themselves in achievement from those who do not?

In closing, sir, the Committee feels compelled to remind you that Aristotle managed to become educated quite satisfactorily without benefit of a pencil.

Jack Turner, director of the Bethel-Eugene-Springfield Teacher Center, Eugene, Oregon, is a regional contributor for Classroom Computer News.

CLASSROOM COMPUTERS

DO THEY MAKE A DIFFERENCE?

The research reveals more questions than answers

by Mima Spencer and Linda Baskin

Is the microcomputer in your classroom really helping Johnny learn to read? Are fractions less troublesome to Laura because she can do drill-and-practice lessons on her computer? In short, do children in school really learn more and have better academic success because they are using computers?

Research results to date answer yes—students do improve their academic achievement when computer-assisted instruction (CAI) supplements regular instruction. Just as television has increased our ability to visualize other places and other times, the computer can increase children's learning by presenting instructional materials in hithertofore impossible ways.

The use of graphics and branching and the built-in testing of concepts and ideas learned in a computerized lesson make CAI particularly effective for individualized instruction. A child can repeat lessons if needed (the computer doesn't tire), can, in some cases, ask for further explanation, can take a test and receive immediate reinforcement or advice on which lesson sections to repeat, and so on, depending on the instructions the lesson designer/programmer has given the computer. Drill-and-practice lessons permit children to review and practice such subjects as mathematics basics, reading fundamentals and foreign

Thomas Spencer

language vocabulary; simulations can evocatively teach economics, history, literature and science.

The Computing Difference

To date, the majority of research on computerized instruction has focused on work with large systems such as University of Illinois's PLATO time-sharing system or Computer Curriculum Corporation materials, which also run on a time-share system. These studies date from the 1960's and early 1970's when CAI was first introduced. For example, in the Elementary Mathematics Project conducted by the Computer-Based Educational Research Laboratory at the University of Illinois in conjunction with Champaign-Urbana public schools, experimental results showed that fourth-, fifth and sixth-grade children using CAI on the PLATO computer system showed positive gains in mathematics relative to control groups. Similarly, researchers found that use of Computer Curriculum Corporation materials in the Los Nietos, Calif., schools reversed a decline in achievement test scores that had continued over 16 years. (For an extensive review of major CAI studies see ERIC document ED 200 187 or a summary of the same report, ED 200 188.)

Assessing Micros

Although such studies of large, time-sharing systems confirm the effectiveness of computer-assisted instruction, few studies have yet assessed the advantages of the newest wave of computers in the schools—microcomputers such as the Apple, TRS-80 and PET. Though the National Center for Educational Statistics reports that the majority of computer-using schools now use microcomputers, the lack of research is no surprise: the first microcomputer was marketed in 1975, the first easy-to-use version appeared in 1977, and even as late as 1979, most microcomputers were purchased for business rather than instructional use.

Lower computing costs, increased computer power and publishers' growing interest in software production have increased use of microcomputers in the classroom, but the microcomputer is still too new an educational tool to have been studied extensively. Much of the research that has been done focuses on the broad issue of whether or not computers improve performance. More specific information about ways of using computer power effectively and related teacher/student concerns should emerge during the next few years as researchers respond to the information needs of practitioners at all levels.

Many considerations affect whether computer technology helps students learn. The most basic of these is also the most obvious: CAI appears to be most effective when the software is good, the student is motivated and the teacher is willing. But many more specific and, sometimes, subtle, questions demand answers. For instance, does anyone know if all subjects lend themselves equally well to computerized instruction? How long should children spend on a particular lesson before moving on to the next one or changing pace with a different activity? Does this period vary according to the child's age and grade level? What balance between computerized instruction and other learning activities is most desirable? Following are some of the areas in which we think research attention is needed.

Shared Experience

One often expressed concern is that computer use in classrooms will isolate students from each other. Some research suggests that this worry may be ill founded. Studies indicate that students who use the computer to collaborate on lessons, play games or learn programming often teach each other as they might during peer tutoring sessions. Such computer-oriented group work may actually provide positive socializing experiences. The children build comraderie rather than avoid it. And they're also likely to benefit educationally from their interactions with each other and the computer. Further research on whether and

when students should work alone at the computer or with others should help answer this important question.

Reinforcement Techniques

The nature of reinforcement techniques in computer-assisted lessons prompts other research questions. Should we program computers to respond with a smiling face (for younger children) or with a phrase such as "That's great!" (for older children) when a child gets the right answer, or should the teacher's comments or the student's internal sense of satisfaction provide reinforcement? When a child repeats a CAI lesson, the reinforcements also repeat. Is this tedious? The graphics and immediate feedback capabilities of computers are undoubtedly among the machines' most exciting educational offerings, but their proper use for such things as reinforcement should be carefully considered. We are presently unaware of any published research addressing this question.

Instructional Needs

Just as some textbook lessons are better than others, so with computerized instruction. One difference, however, is that teachers can easily omit some textbook lessons or introduce other materials to teach certain points. Software, however, must be specifically programmed to allow the teacher and/or learner to pick and choose. Often it is not. This raises the fundamental issues of software design and the integration of computer-based materials into the curriculum.

Just as television has increased our ability to visualize other places and other times, the computer can increase children's learning by presenting instructional materials in hithertofore impossible ways.

We need to discover the best mix of programs that allow students to work through sequences of activities independently and those that require teachers to review the students' work and suggest the next sequential lessons. We need to know whether students can move comfortably back and forth between text and CAI when they've finished one computer-based lesson and the next unit isn't readily available in computerized form. Further, we need a clear sense of how best to integrate computerized lessons into existing curriculum. Research consistently suggests that computerized lessons are most effective when used as supplementary lessons integrated into a regular program of instruction, or when used to provide individualized instruction. Will this change as more extensive software becomes available? Would it then be a good idea for teachers to use CAI to introduce new areas of study? Should some subjects be taught solely by computer?

Scheduling

Another problem teachers face is scheduling students' time on the computer. Whether students use the computer for computer literacy or for math instruction, whether they learn a computer language such as LOGO or BASIC, teachers need to schedule computer use according to children's needs and to their own plans for their students' learning. If you assign lessons to the class as a whole, how can you regulate computer time so that each child gets a turn? Will children learn more if they spend half an hour at the computer once a week or 10 minutes three times a week? How do you assure that a slow learner has sufficient time or that a gifted child who becomes fascinated with the computer's capabilities doesn't balk at returning to more traditional classroom activities? The answers to such questions may well emerge from the kind of teacher-produced research Drs. Zinn and Berger suggest in their article ("What? Me Do Research?" on page 16).

A companion problem to scheduling is determining where to put the computer. If you have only one computer for an entire school but want all students to use it, should you move the computer or the children? One mother of a gifted child reports that her son refused to take advantage of the school's computer elective because it meant leaving his regular classroom and friends. Yet a computer corner in a regular class might mean that students can't use the machine after school hours, though they could if it were located in the media center.

Some research has looked at this problem, and one finding is consistent: easy access to computers for both students and teachers is essential if the computer is to be used to full avail. Further reports on different strategies and their relative merits should help teachers determine how and where to set up their computer systems.

Fundamental Changes

The questions raised above are pressing ones due to the increasing presence of computers in classrooms and the lack of sufficient information on how to use them most effectively. But as computers in the school setting become less novel and research begins to yield information on

Courtesy of Control Data Corporation

Using a touch sensitive screen, a student calls up additional information for a PLATO lesson. Studies have found that such computer-assisted instruction improves learning.

basic questions, other issues, perhaps more fundamental to education, will emerge.

Futurists are already predicting basic changes in the way students become educated as a result of computer use. Learning at home or outside the traditional school building is one widely predicted trend. Students in the future may spend only part of their day in class with teacher and peers. They may spend the rest using a computer at home (or in a special computer center or at a library), where they access computerized lessons, participate in group lessons on-line, or search databases or other information sources. Given the potential for these changes, educators need to consider such questions as: how much interaction between student and teacher is optimal? What kinds of social activities should be structured for students? How much time should students be together in educational activities to encourage cooperative learning, skill development and social learning?

What kinds of curriculum should be designed and will more extra-curricular experiences be needed when students often work independently? An interesting point is whether parents, who may also be working at home on computers, will share in their children's education more than they do now.

Once students are regularly working with a computer system, they will have access to information sources far more extensive than the traditional textbooks. For example, a course or module in current events might involve retrieving and analyzing the latest news about selected foreign countries from a variety of sources, including computerized news files and film sections. Teachers, too, will have access to a wide range of information sources

Studies suggest that the often expressed concern that computers will isolate students is ill founded.

and may use computer networks to exchange ideas with other teachers, consultants and state education agencies' curriculum specialists.

We have no guarantee that children who work with computers will score higher on standardized tests than those who don't (though it seems likely). But few question that students who are exposed to technology in school and who come to take computers for granted as useful tools will be better equipped to enter the adult world where jobs, information and entertainment increasingly depend on understanding computer technology. Instead of viewing computers in the schools as a possible threat to jobs or as a cause of dehumanization, we would be wiser to consider computers as potential allies, which we can instruct to offer students a wider breadth of instruction and a chance to experiment with new kinds of learning.

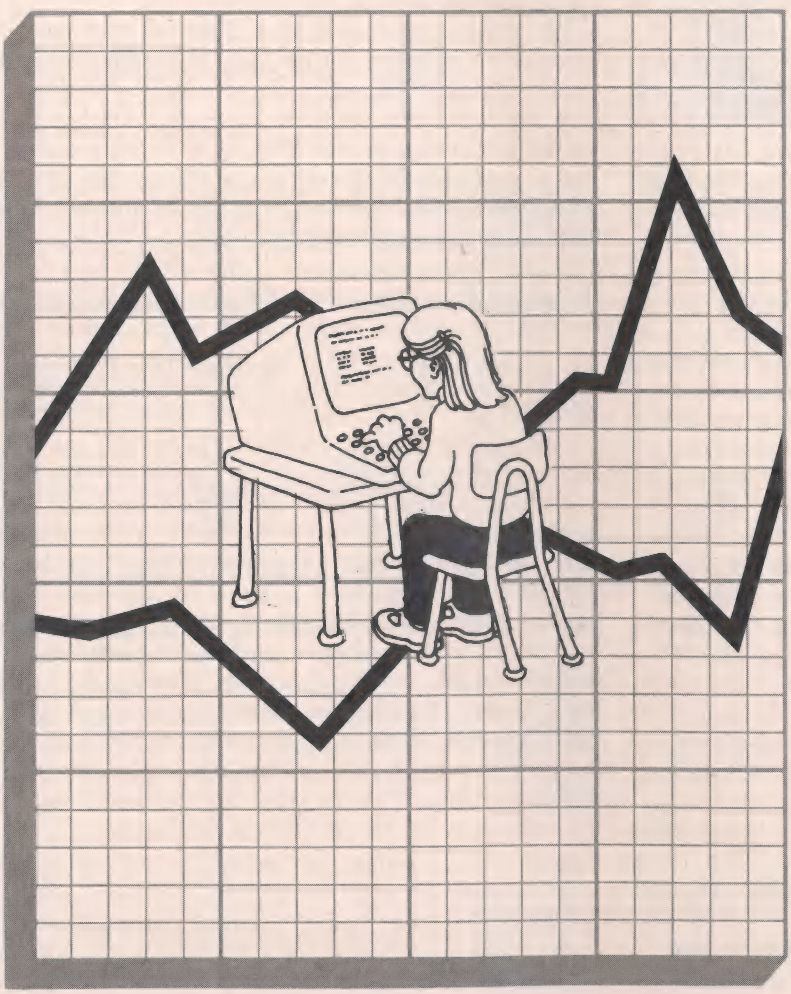
The teacher's role, confirmed in many research studies to date, remains central to students' learning. The capacity to evaluate students' needs and progress, to guide children along appropriate learning paths and to screen materials of all kinds for their instructional usefulness is undeniably the teacher's. No machine, however adroitly designed and cleverly programmed, can take the place of a teacher's professional and personal intuition and knowledge about the children in his or her classroom. Computers can free teachers for the complex tasks of analyzing children's needs, choosing instructional sequences and arranging learning experiences for children that are suitable for their age and level of development. Through continued research, we will learn how best to use this valuable tool. □

Mima Spencer and Linda Baskin are managers at the ERIC Clearinghouse on Elementary and Early Childhood Education at the University of Illinois at Champaign. They are also partners in The Main Branch, a consulting company that focuses on computers, education and information systems, and TWIGS, a computer greeting card company.

WHAT? ME DO RESEARCH?

Of course! say two top researchers, and they tell you how

by Karl L. Zinn and Carl F. Berger



When a computer enters your classroom probably the last thing you think of doing is research. You need programs, scheduling ideas and clues on how to use the one-eyed monster with your students. The furthest thing from your mind is the statistical mumbo jumbo and hypothesis generation you last saw in a research or science class in college. But something called *action research* may be just the thing to help you answer questions about how, when and where to use computers in the classroom. Even more important, your results will help others in their decisions about use of small computers. Informal research can help you and your colleagues avoid programs that are more flashy than functional.

Action-oriented research is reported in newsletters and popular magazines with a straightforward, often conversational narrative to convey impressions and feelings as well as objective results. Such informal research is not typically published in a research journal, nor does it lead to a Ph.D. But it does provide answers to immediate questions of teachers, parents and administrators. Usually the results are so obvious that a simple chart or graph is sufficient to demonstrate the worth of the experiment.

Getting Started

How do you get started with action-oriented research? Personal computers and classrooms are both just about the right size for informal research. Action research works best with three people: teacher, administrator and researcher (sometimes from a college or university). You'll get together to identify interesting questions and to plan what needs to be done. The researcher contributes ideas from other studies and methods. The administrator shapes the questions of cost, schedule and other

limitations on resources. And the teacher, the most important person in the collaborative, determines the usefulness of the experiment based on the realities of classroom situations, the relevance of proposed learning activities and a concern for individual students.

Informal research can begin with anything you may be wondering about as you introduce microcomputers into your classroom activities. You're not trying to test whether microcomputers are better than other kinds of instruction, but how microcomputers might be better used in the classroom. Don't worry about matched control and experimental groups, teacher preference favoring one kind of instruction or the famous (infamous?) Hawthorne Effect (anything new or different gets the attention of students). You're looking for strong evidence of how microcomputers and students best interact.

What kinds of questions are interesting? You decide! Begin with problems students encounter; their questions and comments can help form your research ideas. You'll be trying out different ways of using computers anyway, and the problems and joys you encounter will provide a basis for your research. Make sure your questions are clearly stated. For example: how are students best scheduled to use a microcomputer? What kind of application program works well with 40 students and one teacher? How many students can work with one microcomputer at a time on their own? This last question brings up an important point. You've heard that one computer for each student is the optimum situation. That seems common sense, but Dorothy Cox, a science teacher in the Ann Arbor, Michigan, area, found that more than one student per computer is much better in certain problem-solving situations. (See "Microcomputers Are Motivating," *Science and Children*, Sept. 1981, 28-29.) Some other ideas that may be important to you are listed in the box.

Ideas for Classroom Research

- Which of your computer activities results in your students doing more on their own?
- What kind of class arrangement results in students scheduling their own computer use?
- What computer programs best improve learning skills apart from the computer?
- What computer learning activities work better with peer guidance or tutoring?
- What class arrangements and programs work better for small groups than for individuals?
- If the responsiveness of the computer is changed, what happens to student interest?
- What subjects and objectives are best for simulation and modeling activities using computers?
- Which programs encourage creativity and why? (For example, in writing, graphic design, music composition.)
- How do attitudes change when graphics are added to the displays of instructional computer programs?
- How can computer activities improve student attitudes toward learning, technology and the subject matter?
- How are values affected, for better or worse, as a result of introducing computing activities into the classroom?
- How can students benefit from programming their own learning activities for one another? □

Graphic Reporting

How do you report action research? (Hah! You knew there'd be a catch!) Because the research is less formal, positive results will be evident and easier to report. A conversational, narrative style can include clear anecdotes about student reactions and successes (or failures). You can also use percentages and graphs. You may find statistically significant differences, but if they aren't obvious in graphs or cannot be easily seen in percentage tables, you'll have a tough time convincing your principal or school board of the value of your findings. Diagrams are what impress: the amount of time students spend with microcomputers on their own time; the increasing amount of work accomplished in a fixed time as students use microcomputers more and more. Have a look at the graphics in this issue!

How should informal research be disseminated? You may be doing research informally already but not reporting the results. You should be writing reports for principals, school boards and parents using the regular channels of communication for your school. Probably you should send the results to periodicals such as this one. And if people challenge your results, that's great! They may try your experiment themselves and disprove some of their pet theories.

Finally, have fun! The enjoyable arguments, team effort and overall accomplishment can make action-oriented research worth all the effort. Remember, the best research is that which benefits you and your students. You can't help getting involved anyway, and a little more effort makes your experiments helpful to others. So share what you learn from your own informal research and help make computers more effectively used and more accepted in any school system. □

Drs. Karl L. Zinn and Carl F. Berger are both on the staff of the University of Michigan, Ann Arbor, and are both actively involved in educational computing research. Dr. Zinn is a regional contributor for Classroom Computer News.

A Call to Action

On page 18 of this issue, you'll read about the action-oriented research that teachers around the country are doing—both with and without the aid of university researchers. Do you have some action-oriented research results to share? Send a brief description of your project, along with any graphs or charts, to Action Research, *Classroom Computer News*, P.O. Box 266, Cambridge, MA 02138. We'll pay you $35 for any item we print.

ACTION RESEARCH ROUNDUP

What three studies show about computer-based learning

Improving Problem-Solving Skills

One often recommended use of microcomputers is for teaching problem-solving skills. Research by Carl Berger, Ph.D., associate dean of University of Michigan's School of Education, Ann Arbor, suggests that this is indeed a valid use of classroom computers.

In ongoing research begun in December 1978, Dr. Berger has monitored 220 students as they've worked with a program requiring estimation of linear distances. The students ranged in age from kindergarteners to ninth graders; they included special education students as well as those already taking college-level courses.

As students worked with the program, which required them to estimate the location of a balloon on a wall, Dr. Berger and his associates monitored the accuracy of student estimates, the amount of time required for an accurate estimate and the kinds of strategies employed. They hoped to see a drop in time and the development of sound strategies as students become more familiar with the task. Results in the earliest studies, which involved seventh through ninth graders, indicate that this occurred for every student. "There is something about the microcomputer and the *feedback* it gives that encourages [the development of problem-solving strategies]," says Dr. Berger.

The computer program challenged students with three levels of difficulty. At all levels, students had to break a total of ten balloons (student input of the estimated location of the balloon activated a dart), but at Level I, the path of dart and the number of the estimated location appeared and remained on the screen. In addition, the top position on the screen was labeled five; the lowest, 100. This information provided students with a visual frame of reference.

At Level II, the balloon was positioned between five and twenty. Neither the dart path nor the number remained on the wall. However, the last estimated number appeared at the bottom of the screen. The Level III program provided no frame of reference, requiring students to remember all necessary information.

Students encountered all three levels of difficulty, with a minimum lapse of two days between sessions (most students participated in a total of four sessions). A computer-calculated curve revealed that students at Level I took a long time to estimate the location of the first balloon correctly, took slightly less for the next few balloons, then speeded up dramatically before levelling off. Level II results showed a significantly lower beginning time, indicating that students had learned from Level I. The drop in time was less dramatic, reflecting the increased difficulty, but the time used for the last balloons was less than that for Level I. The Level III "curve" was a straight line. Beginning time dropped, but no additional time decrease followed. Apparently students had reached the limit of their short-term memory processing.

As to strategy, three types of youngsters emerged. First were the Random Guessers who used no strategy, evidencing a feeling that what they did made little difference. The second group was dubbed the Bracket Kids. They made a high estimate, followed it with a low estimate, and then

bounced back and forth within this bracket until they hit the balloon. A third group, the Sneakers, estimated too high or too low but then inched toward the balloon from one direction. Strategy did not correlate with academic achievement — special needs and regular students were equally likely to begin with one or another of the strategies.

However, a follow-up session six months after the initial sessions found no Random Guessers — all students employed a strategy. Though researchers noted some erosion in beginning time, Dr. Berger says "the kids came right back and the drop in time was tremendous."

The second phase of the project involved kindergarteners, first, third and sixth graders. Here Random Guessers were more prevalent; students needed more time. "You could just see the short-term memory shorting out," says Dr. Berger of the youngest students. This affirms, he comments, their need for "concrete anchoring." Though these students required more time, all showed improvement.

Dr. Berger notes that many of the middle-school students in his study had not yet attained the expected level of abstract thinking. When used judiciously, he says, microcomputers can be powerful tools for developing this skill. But he cautions that if computers in education are used merely to occupy student time, they will end up on the shelf. — **Gloria Stein**

Higher Achievement for High Achievers

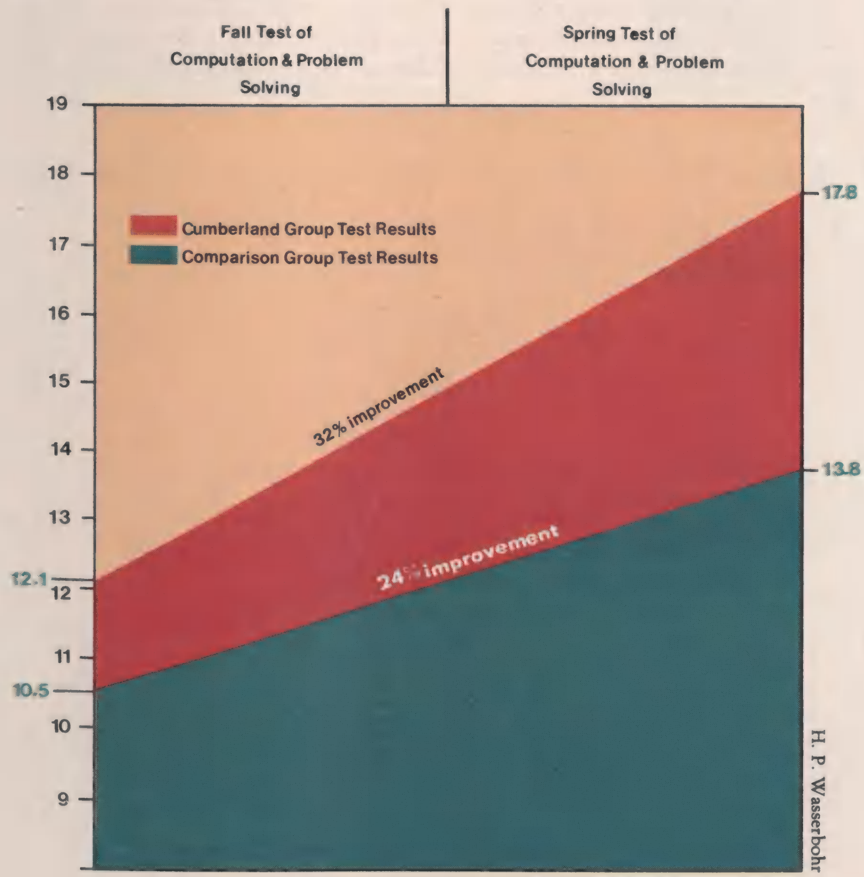
Access to microcomputers can help children who are already high achievers develop greater problem-solving skills than their equally high-achieving peers, and can also foster more positive attitudes toward math. These were the findings of a 1978-1979 study of fifth- and sixth- grade high achievers in math conducted by Bob Foerster and Jeanne Goris, teachers at Cumberland Elementary School in West Lafayette, Indiana, with the aid of Purdue University's Gifted Educational Resources Center.

The top 27 percent of Cumberland fifth and sixth graders taking the math achievement subtest of the Stanford Achievement Tests were the experimental group; the top 27 percent of fifth and sixth graders at other West Lafayette schools comprised the control group.

Students in the experimental group were given access to calculators and computers and were encouraged to use a heuristic approach to problem-solving. Students learned BASIC and programming skills only as they needed to for solving math problems and assignments. They were encouraged to compare and analyze solutions.

At the end of the year, the students were tested again on the math subtest of the SAT. Cumberland students started the year 1.6 points ahead of the control group. At the end of the year, both groups showed progress but Cumberland students had pulled ahead of the control groups by four points. Their computational abilities did not suffer. In addition, Cumberland students had a higher positive attitude toward math as measured through researcher and outside professional observations and on a student attitude survey.

Since 1979, the school system has continued the program without the help of Purdue, and has sought to expand it to other West Lafayette schools. — **Phyllis Caputo**



H. P. Wasserbohr

Uplifting Math Scores

Despite the dizzying growth of microcomputer use in math education, few studies have carefully examined the effects of computers on the mathematics learning process.

In 1979, Fremont School, a public third- and fourth-grade school in Hollister, California, bought eight Apple II microcomputers to use in teaching basic skills. Faculty decided to conduct an informal study to see whether or not the computers really made a difference. We are reporting the results of that study both to demonstrate the learning gains possible with microcomputers and to encourage other schools or districts to carry out and report similar studies.

The Fremont study used pretests and post-tests to compare the progress of two groups of fourth graders, one of which received daily sessions of computer-assisted drill and practice as a supplement to arithmetic studies while the other received traditional instruction. All the students had attended Fremont School in the third grade, and all had taken Book 13C of the California Achievement Test at the end of that year. The average test score for each group was 3.0, about one year below grade level.

Once in the fourth grade, half the students remained at Fremont School while the other half attended a school in another district that had no computers. All the students were recommended for instruction by their teachers. Thus, the two groups were similar in prior achievement, had attended the same school the previous year, were matched on pretest scores and received similar instruction except for the computer. The post-test was Form 1-S of the Comprehensive Test of Basic Skills (CTBS), which all fourth graders at both schools took in May of 1980.

The experimental group spent approximately 15 minutes a day at the computer center, where they used one of two drill-and-practice programs — *Math Facts* and *Math Levels* — created by Richard Pitschka, the Fremont teacher who administered the program. *Math Facts* is a set of 23 programs that drill basic facts from single-digit addition through single-digit division with dividends up to 81; *Math Levels*, a set of programs coordinated with the Scott, Foresman textbook series *Mathematics Around Us*, provides problems that both cover new material and offer review.

While at the computer center, students could work with manipulative materials or ask an aide for help with their math. Their programs were selected by computer center staff, based on previous progress. Staff printed progress reports daily; they used *VisiCalc*, the "electronic worksheet" program, to maintain student records.

The computer time paid off. The experimental group scored significantly higher on the post-test than the controls (the estimated grade levels were 4.7 and 3.9 respectively). They also showed a lower spread in post-test scores and a lower correlation between pretest and post-test.

The results of this small study should encourage teachers and administrators who wonder whether computers can help below-grade-level students improve basic skills. We hope that other school districts and researchers will pursue more complex studies in this area to extend and perhaps support these results.— **Richard Pitschka and William J. Wagner** □

About the authors:

Gloria Stein is a sixth-grade teacher in Ann Arbor, Michigan.

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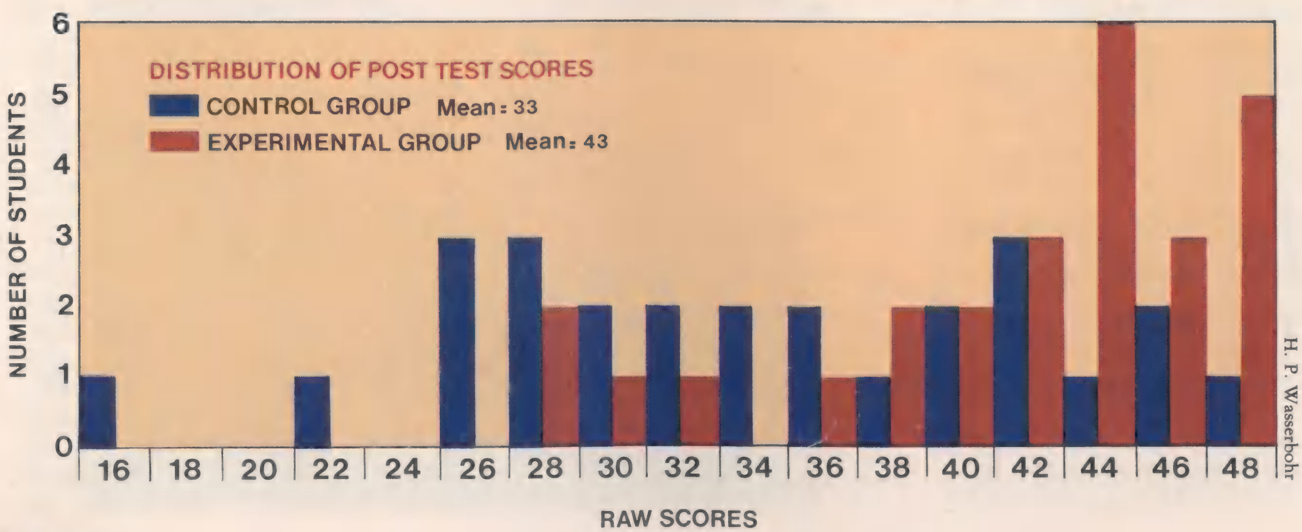
William J. Wagner is coordinator of computer education, Santa Clara County, California.



BUILDING BETTER MATH EDUCATION

A National Science Foundation executive looks at how computers can enhance math education

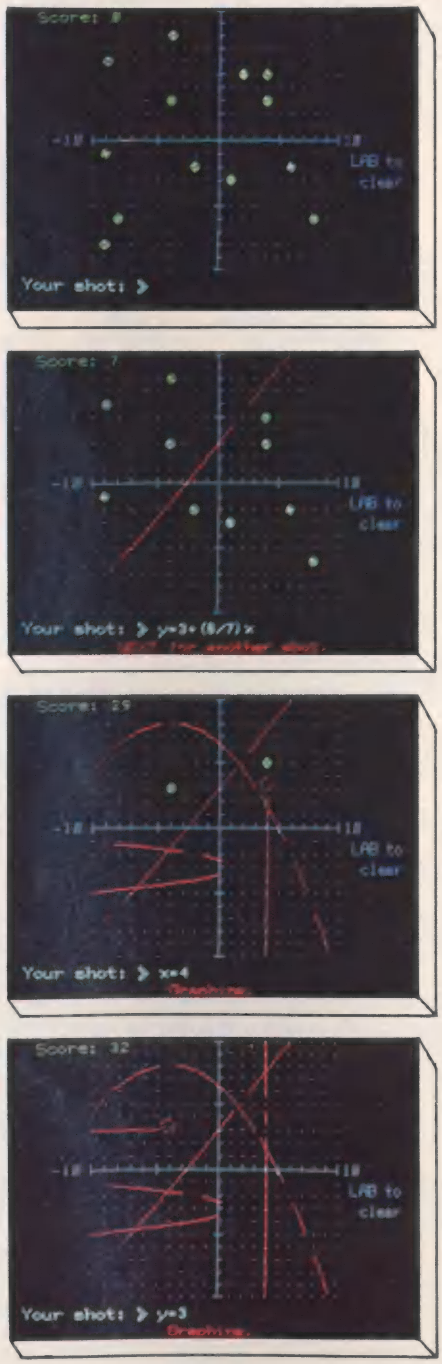
by Dorothy Derringer

For the junior who fancies herself a future Madame Curie, for the senior who dreams of engineering the first cost-effective photovoltaic cell, for the ninth grader who found the returns from Voyager II more exciting than the end of the baseball strike, good mathematical skills and, increasingly, good computer skills, are a prerequisite to future professional success.

As the federal agency mandated to improve science and science education in the United States, the National Science Foundation (NSF) has taken an active interest in the education of these future scientists, engineers and technicians. For over 20 years, NSF's Development in Science Education (DISE) Program and its predecessors have supported projects that use computers to improve mathematics education. DISE has funded 36 projects over the past two years, all of which have developed prototypes of computer-based materials for teaching, learning and doing mathematics.

The DISE Program seeks projects that exemplify the improvements computers can make in the traditional mathematics curriculum. What changes are possible? For one thing, computers can help instructors emphasize the spatial and dynamic qualities of mathematics. These are among the most difficult aspects of math for students to master. Consider the geometry student trying to fathom the concept of congruency. Where the textbook offers static illustrations of congruent triangles, the computer enables the student to manipulate the triangles, perhaps stacking or turning them until the equalities that define congruency are apparent.

Computers can also improve instruction that exercises and tests students' problem-solving skills. Recent National Assessment of Education Progress findings indicate that students perform basic arithmetical operations well, but that their abilities to handle complexity — to solve problems, to understand a problem and to choose an appropriate method for solving it — are declining. A preliminary study by John Clement and Jack Lochhead at the University of Massachusetts indicates that students who write computer programs improve their problem-solving abilities. The rigor of creating an appropriate program design and the process of testing the quality of the program on the computer seem to make the difference.



In this DISE-funded algebra game, students create equations to hit the "green globs."*

In addition, computers can more readily demonstrate the usefulness of mathematics: such applications as creating computer music and art help build an understanding of mathematics as a sophisticated language — a tool to facilitate communication. They can enhance the mathematics learning environment by enabling students to generate and solve problems, and can help students absorb mathematical ideas at earlier ages. Introductory statistics, for example, has been considered an undergraduate or advanced high school course because of its cumbersome data-handling techniques, not because of the complexity of statistical ideas. Using the computer to manipulate the data, children as young as 11 or 12 can explore the concepts of statistical surveys and of data collection and analysis, concepts many of them enjoy.

As part of the DISE program, NSF held four regional meetings around the country this summer to discuss with experts the changes we could and should expect in math education given the availability of computers and to ascertain what conditions will assure that these changes take place. Our groups agreed that identifying

DISE Projects

The DISE-funded projects draw attention to several important questions for educational computing research. Among them are:

Can Young Children Learn Mathematics Using Computers? Ten years ago, conventional wisdom held that a fourth grader was the youngest child who could use computers effectively. Microcomputers with color and sound have changed that perception. Several DISE projects have addressed this question. Among them is a golf game that teaches students to estimate length and angles and a geometry unit for second and third graders. Preliminary results indicate that young children can become "mathematics ready" with the help of innovative, computer-based materials.

Can Students Improve Problem-Solving Abilities? The term "problem solving" covers a wide variety of topics. The current interest in problem solving includes the mathematical statement or word problem of the past. It also includes real-world problems that may have more than one correct answer, and decision-making skills and procedures. One of the goals is to help students learn good methods for identifying, analyzing and solving problems. Among the DISE researchers addressing this problem are Mary Grace Kantowski at the University of Florida who is working on both mathematical and real-world problem-solving for Grades 5 through 12, and Judah Schwartz at the Education Development Center, Newton, Mass., whose work explores word-problem solving in contexts of interest to junior high school students.

Researchers are finding several of the computer's capabilities valuable for teaching problem-solving skills: the computer can illustrate a situation with moving graphics; it can provide feedback as students explore and experiment with several solutions before making a decision; it can supply problems with realistic numbers rather than numbers chosen to "come out even."

Why Not Use Color? Many projects are using both color and sound, but few offer any rationalization for why these features are useful beyond their attention-getting qualities. The effective use of color and sound are both areas of opportunity for further research. Only Wallace Feurzeig's project at Bolt, Beranek and Newman, Cambridge, Mass., is researching the effective uses of sound in mathematics software. Good research on the motivational and instructional reinforcement abilities of sound and color is also needed. Many projects using black-and-white monitors, by the way, chose them intentionally because they provide the better resolution necessary for accurate graphs and diagrams.

How Will Computers Change the Structure of the Learning Environment? Is the computer a tool for the teacher or a tool for the student? Should we write instructional software that enables students to work alone or in groups, or should we create packages that are aides for teachers? Researchers are taking both of these approaches as we feel our way toward the computerized classroom of the future—**D.D.** ☐

diverse, innovative, promising and successful new aproaches—the goal of DISE—is a crucial part of the challenge. But they also stressed that innovative strategies require the attention of the educational community—parents, teachers, state and local government, and professional societies—before improvements can be available to many school children.

At a final retrospective gathering that included representatives from all four meetings, the participants concluded that in addition to innovative ideas, the following conditions will be necessary for real improvement in mathematics education to take place:

- High-quality, reliable hardware and software must be available in sufficient quantities if educational computing is going to have an impact on schools. We need hardware that works consistently, software that is easy to use and reliable, and large quantities of high-quality instructional software if computers are to be used consistently and productively by all teachers and students.
- Educators—teachers, administrators, school boards—must receive information and education about the enhancements and changes in mathematics education and about the use of the computer itself (computer literacy).
- We must create structures that offer support and continuing education for teachers in the classroom. Teachers need continuing support in the use of hardware and software (telephone hot lines or "800" numbers to experts, for example) and continuing assistance in using computers creatively and effectively in class.
- A computerized approach to mathematics education should be available to *all* citizens. Knowing both mathematics and computing provides access to high-level jobs and professions. All of our citizens should have access to these new skills.

Our experience at NSF underscores the importance educators have placed on computer use in the mathematics curriculum. Mathematicians and classroom mathematics teachers, not computer scientists or necessarily even computer specialists, are developing new tools for the classroom. Their enthusiasm is based upon their ability to create new, compelling tools for teaching mathematics.

Although the results are still preliminary, we sense that many students who were uninterested in mathematics become interested and involved once computers are introduced. While innovations always stimulate motivation, project after project reveals heightened motivation for mathematics among students using computers. This appears to be more than just a Hawthorne Effect. The DISE projects are building blocks for new mathematics curricula, allowing us to explore what is possible. ☐

Dorothy Derringer is acting program director of the Development in Science Education (DISE) Program, National Science Foundation, Washington, D.C.

The views expressed herein are those of the author and do not necessarily reflect those of the National Science Foundation.

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* *Green Globs* by Sharon Dugdale, University of Illinois, Champaign-Urbana.

COOPERATION and COMPUTING

How you can use that "impersonal" machine to improve students' interpersonal skills

by Robert Isenberg

True or false: Computers isolate children and thus pose a threat to traditional values such as concern for others, cooperation and person-to-person communication. Sadly, many people —including teachers—would agree. with this statement. Many of them fail to see that the computer can be an excellent tool for teaching and reinforcing the interpersonal skills they feel it threatens.

Virtually every teacher has had students whose feelings of peer rejection or need for attention and group status have aggravated behavior that has disrupted the class. These behaviors arise from basic and legitimate human needs. By recognizing these needs and identifying the skills students need to fulfill them in positive ways, teachers can establish better learning environments. The microcomputer or in-class terminal used as the focus of group activity can help.

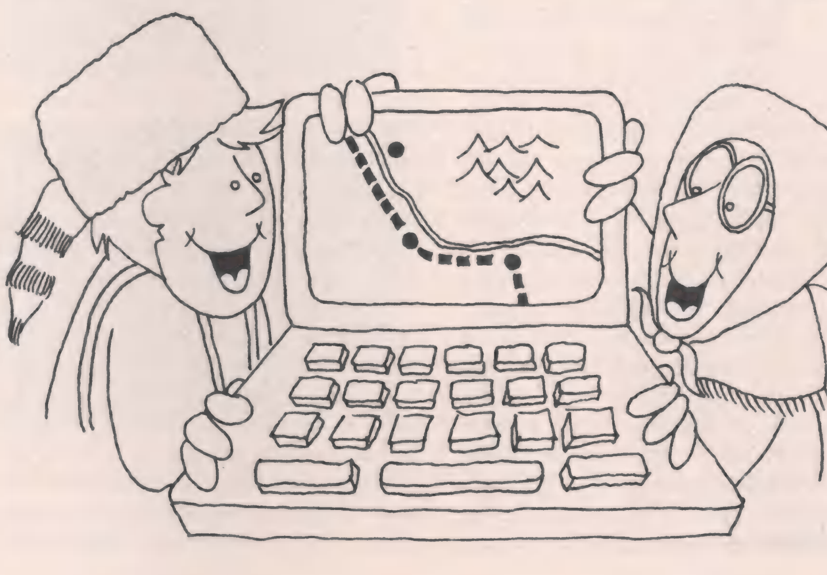
Studies show that a cooperative group structure is most effective for teaching social and cognitive skills (see Johnson, David W., et al., "Effects of Cooperative, Competitive, and Individualistic Goal Structures on Achievement: A Meta-Analysis," *Psychological Bulletin*, Vol. 89, No. 1, pp. 47-62). Such groups foster greater feelings of trust, more positive feelings of self-worth and better awareness of the needs of others. The key to establishing these cooperative groups during computer activities is structuring social interaction at the terminal so that students are aware of their dependence upon other group members in accomplishing their goal. Here are two examples of how existing computer programs can be used to teach social skills through cooperative groups.

Cooperation on the Oregon Trail

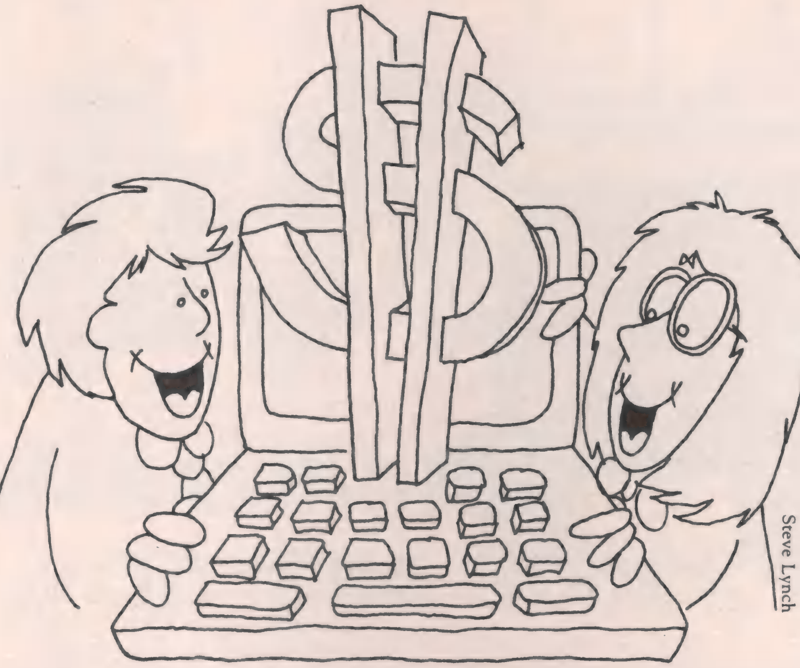
Oregon Trail is a popular simulation of the trek made by pioneers across America in the 1840's. Students of all ages and abilities love to do and re-do the simulation, hoping to avoid freezing or starving to death. Because of its popularity, I've used it as a first experience to familiarize my eighth-grade social studies students with the terminal. However, some students anxious to play the simulation have trouble reading the information that appears on the screen. I use the following plan both to enable all students to participate and to teach some basic social skills.

I first describe the nature of the simulation and tell students that they will be making the trek in groups of two. Their success as a group will depend upon how far the two of them progress in their journey. I reinforce this interdependence in two ways. No input is allowed into the computer unless both agree on an answer to each of the simulation's many questions. Furthermore, in each group, I assign one student as simulation reader and one as keyboard operator. If one student performs the other's role, the team is "fined" 100 miles progress in the journey.

The teacher needs to ensure that



Steve Lynch



one student in each diad is capable of reading the simulation. You can either assign students to groups or use some combination of random selection and teacher placement. One good way to establish groups by random selection and to reinforce computer knowledge is to count-off using computer terminology — you'll need as many terms as there will be groups.

Depending upon the age of the students and their experience in cooperative groups, you'll need to clarify additional rules. These are rules that facilitate cooperation within groups. You should present them in terms of observable behaviors and should provide demonstration. Such rules might include: ask each other's opinions in order to encourage participation and to assure agreement; ("What do you think we should do, Andy?") check for consensus ("Do we both agree that we should enter the number 50?"); question for clarification ("I don't understand, what does that statement want us to do?")

Your students will learn these skills more readily if a third member is assigned to each group as a non-speaking observer. Equip this student with a check-sheet of the social skills and behaviors you want emphasized. After the students have completed the simulation, each triad should review the observation sheet and evaluate how they've done in a positive, constructive manner. If this self-evaluation is new to the students, you might role-play or otherwise give guidance on the way it should be done.

Market Savvy

An excellent simulation requiring more sophisticated cooperative group skills and some math ability is *Market*. In this simulation students form companies that compete for a share of the market place. The company members determine price, production and advertising budget. The computer uses this data from each company, while adding variables such as strikes and wage-price freezes, to determine each company's profits, net worth, sales and share of the market.

The breakdown and distribution of tasks among the group's members can both create positive interdependence and allow less capable math students to participate. The better math students are the company's mathematicians or accountants, while those less mathematically capable become company record-keepers or decision-writers. All help make policy decisions. Because each company must evaluate data in light of numerous variables and unknown tactics of other companies, this is an excellent opportunity to teach group decision-making skills (and, occasionally, conflict-resolution skills). Students, with a little guidance, will find that success in this intergroup competition requires intragroup cooperation. The computer's ability to process information quickly and to give immediate reward or punishment heightens the excitement and increases the need for effective group process skills. Skills you might emphasize and demonstrate beforehand include: checking for consensus, asking for clarification, identifying disagreement and taking perspective. Because of the larger group size (in my experience four students seems best), and because of the degree of interaction one can expect, *Market* is best played with experienced student observers in each company.

Almost any existing computer program can be adapted to teach social skills. The first step is to impress upon students the link between cooperative skills and achieving their goals. As students master and internalize these skills, new ones such as paraphrasing or role-reversals can be demonstrated, taught and practiced. That "impersonal" machine will quickly become the servant of personal social skills. □

Robert Isenberg is an eighth-grade teacher at Marquette Middle School, Madison, Wisconsin.

Resources

Oregon Trail and *Market* were both produced by the Minnesota Educational Computing Consortium. They both run on a disk-based Apple microcomputer with 48 K of memory and are available from Creative Computing, 39 E. Hanover Ave., Morris Plains, NJ 07950; 800/631-8112. *Oregon* is one of five programs on Elementary Vol. 6 Disk (catalog no. MECC-725; $24.95); *Market*, which Creative Computing calls *Sell Bikes*, is one of seven programs on Elementary Vol. 3 Social Studies Disk (catalog no. MECC-704; $24.95).

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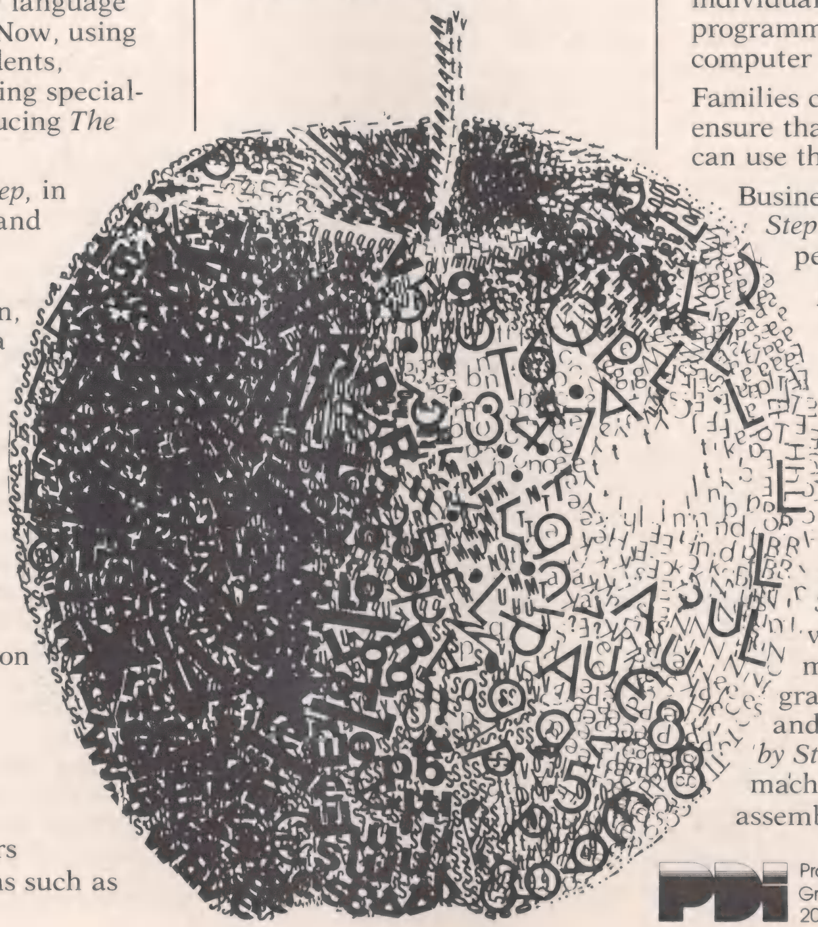

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The computer program shows screen displays or sample program outputs, while the audio cassette explains to the student what is being shown. After each instructional segment, the student is asked a question or asked to solve a problem. The computer checks the student's work.

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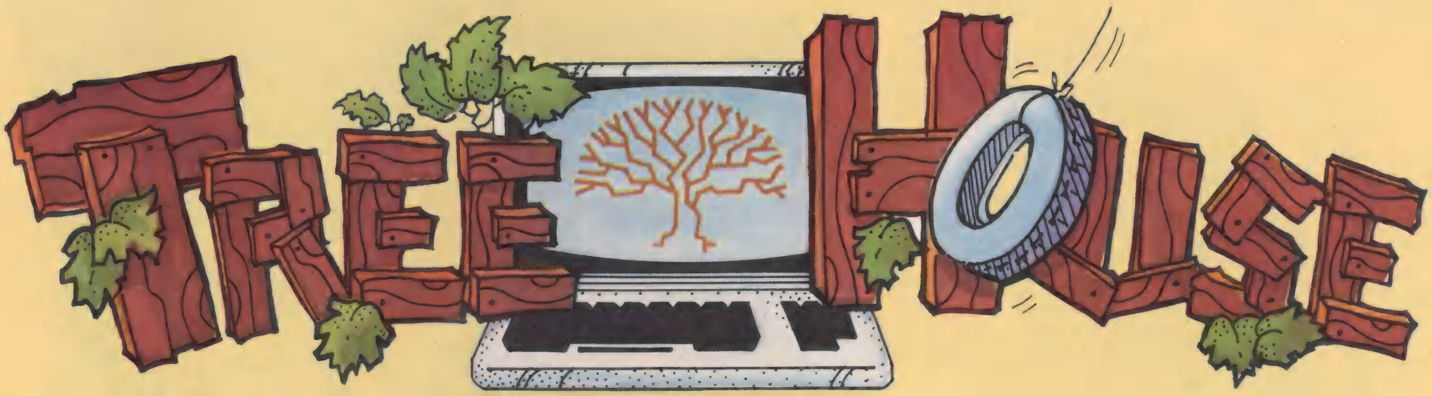


Make money— on the Stock Exchange!

Quick, think of a way to make money. Baby-sitting, washing the car, running errands, bagging groceries, having a newspaper route are all ways to make SOME money. But they all take SOME time. There's got to be an easier way.

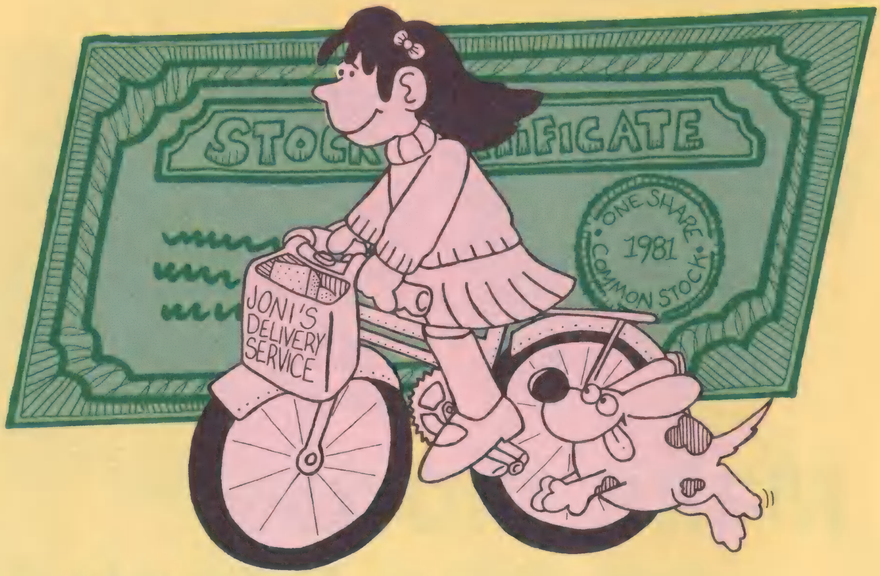
Ever considered the stock market? For more than 100 years, people have bought shares of stock, hoping to make money from stock dividends and from selling the stock at a price higher than what they paid for it.

One of the tools today's investors use to help them decide what stocks to buy and sell is the computer. And if you have a computer at school, at home or even in the neighborhood, you and your friends can use it to find out how the stock market works.

Computers do many important jobs in the stock business. They allow people in any part of the United States to get up-to-the-minute information about stock prices. They also store all the records from the millions of shares of stock that are traded each day.

Record-keeping at stock exchanges wasn't always so complicated. In the early days of stock markets, stock traders wouldn't have needed computers even if they'd had them. In the 1800's, stock trading was a simple business. As the county expanded, people needed more goods — everything from hats to cultivators. Americans formed companies to manufacture these products. To get the companies started, they needed money to buy machines and hire workers. So they sold "shares" of ownership in their companies to wealthy investors. If the business grew, the "shares of stock" became more valuable. And as an added benefit, the companies split their profits with their "shareholders" in the form of stock dividends. Often investors would meet on street corners in large cities to buy and sell stock among themselves. Some of these investors started making deals for other people. These stock "brokers" began many of today's stock exchanges.

By the 1920's, people from all walks of life began to buy stocks. And by the 1960's, with America's population rushing toward 200 million and American business booming, millions of shares of stock changed hands each day. The stock markets couldn't handle the record-keeping. Some markets even had to close a couple of times to catch up with the paperwork. Then along came the computer to save the day.



Businesses create shares of stock, and use the money from their sale to pay for new expenses. Joni sold stock in her delivery service so she could afford a new bike.

The speedy machine

Today in a typical trading session at the American Stock Exchange hundreds of brokers bargain and shout and wheel and deal. They make 20,000 transactions by the time the market closes. The important information from each purchase and sale is stored in a computer within seconds of the deal. By the end of the trading session, the work involved in recording this information is almost done. The same work used to take many clerks most of the night.

Just how much time does a computer save? To find out, try doing a "time study."

On a piece of paper, write down the name of a stock, a price, the date, and your name. Now make three copies of the name, price and date. Put one in an envelope marked "Company name." Put the second in an envelope marked "Date," and the third in an envelope marked "Account for (your name)." How many minutes did that take?

Now file the envelopes somewhere. Remember to file each envelope so that you can find it easily in a group of 20,000 other envelopes.

How much time did the whole process take? Now multiply that time by 20,000. Divide by 60 to see how many work hours it would take to file this information. At eight hours a work session, how many workers would you need to organize one day's paperwork? How long would the same job take a large computer? Once the name, date, price and company name are written on special cards, the whole process would take a couple of hours at the most. Plus, the computer can find any single record in a few seconds.

The computer's speed has another benefit. It helps people make more money. Stock exchanges are markets just like flower markets or fish markets. At any kind of a market, people can make money if they know which products selling at a low price are likely to go up in price. Computers play a key role in reporting stock prices within seconds of some stock being bought or sold.

With up-to-date information on prices, investors can then decide whether they too want to buy some new shares of stock or to sell shares that they own.

Imagine that a toy stock selling at $30 a share drops to $28 and that 1000 shares are for sale. An investor hears that a large department store is buying millions of dollars of the company's toys. She buys the thousand shares at $28, expecting the toy sale to make the stock's price go up. It does — to $35. She sells and makes a $7000 profit.

Computers play a key role in trading stock because they get information to people fast. What if our investor hadn't known that the stock dropped to $28? What if she hadn't know that 1000 shares were for sale? She couldn't have made the deal.

How important is speed in reporting stock transactions? It was never so important as on Black Monday, the day the stock market crashed in 1929. Stock prices were then reported over telegraph lines to special machines called "ticker-tape" machines. This system worked fine until large number of people wanted to buy or sell at the same time. On Black Monday, stock prices fell, and people tried to get whatever money they could from

their stock. As more and more people tried to sell, the reports of stock prices became later and later. Soon the ticker-tape was running an hour and a half behind schedule. Thousands of people might have sold their stock had they known how fast prices were falling. But they didn't know until it was too late and their stock had become valueless.

The stock analyst's helper

Another important job computers do in the stock market is help people decide which stocks to buy and sell. Stock *analysts* use special computer programs to look at many kinds of information about a company. What kind of profits has the company had? How much are the dividends for each share? Does the company pay them regularly? What is the company's management like? How stiff is the company's competition? What is the future for the company's products? The computer program takes all this information and puts it together in different ways. It graphs part of it. It show trends. It does comparisons.

The kind of analysis the computer does for a stock broker is like the study you might do to pick the winner of the Superbowl. First decide what information you need to know about each team. Then put a value on each kind of information. One team has an injured quarterback. Its opponent has a rookie coach. How do you rate these facts? From what you know about pro football, you devise a formula. Your formula might rate the quarterback problem a -3 and the rookie coach a -1. Finally, gather all the information for your formulas, plug the information in, do the arithmetic, and . . . ? With luck, you'll get a number that shows which team will win.

Try out your analytical skill. Below are some factors to consider in predicting which team will win the superbowl. Put the factors in your order of importance. Decide how much more important one factor is than the other. Compare your analysis with a friend's.

Player's ability and experience
Win/loss record
Team's season's statistic's defense
Momentum toward end of season
Season statistic's-offense
Expert's predictions
Injuries
Past playoff experience
Home field advantage
Coach's record

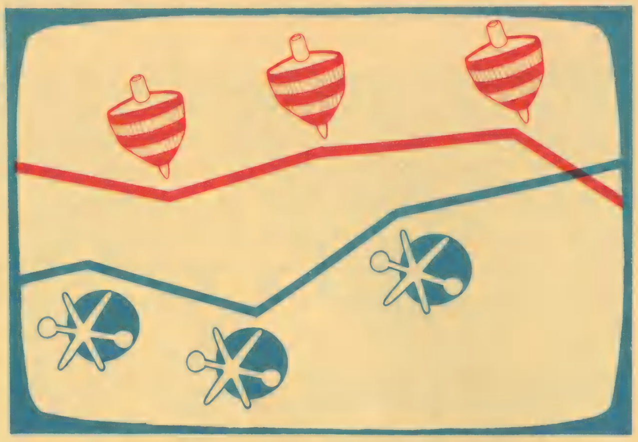
Bears and bulls

Information about a company isn't all you need to know to pick a stock. World events ranging from peace treaties to presidential elections to the price of sugar also influence stock prices. This is because politics and economics affect people's *faith* in stocks. If people think political or economic change will be bad for business, they sell their stocks. The stock market goes down. If people think change will help business, they buy more stock and the market goes up. Down markets are called "bear markets"; up markets are "bull markets."

Look at today's newpaper. What world events do you think might influence the stock market? Will they make it "bullish" or "bearish"? Could someone program a computer to predict how world events will influence stocks? Or must people make these judgements?

Pretend you have $100 to invest in stocks. You ask a stock broker for help in choosing stock. You think that toy company stock might be good, so your broker would pick some toy companies to analyze. She would look at what kinds of profits each company has made over the past couple of year. And she would ask other questions. How do the sales of each of the toy companies compare? How fast are the prices of materials toy companies need rising?

The stock broker would use a computer to figure out which toy stock would be the best buy. She would enter the information on sales, profits, and so on into the computer. And the stock analysis program would graph the closing price of the stock over the past months for her.



It would rate the statistics for each company, and predict the future earnings for each company. With this information she would recommend a toy stock for you to buy.

Follow your own stocks!

One of the ways you can learn about the ups and downs of the stock market is to graph the prices of some of your favorite stocks. *Treehouse* has a program to do just that. It will graph the closing prices of up to five stocks over 20 days. And thirty people can each use the program to follow the progress of their stocks. Fill in the blank below and send it to *Treehouse,* Classroom Computer New, P.O. Box 266, Cambridge, MA 02138. We'll send you a free program.

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Softlights

By Fred Huntington

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TEXT EDITING

Let the computer turn students into scribes

by Frank DiGiammarino

You can justify the purchase of a microcomputer with a printer for classroom use even if you never intend to use the equipment for computer literacy, drill and practice, simulation and/or problem solving. What's more, you can continue to justify its purchase after a one-time expenditure of less than $100 for software. Impossible? The uninitiated might think that purchasing a microcomputer necessarily leads to increasing expenditures for software, but our experience with text editing at the Lexington Public Schools, Lexington, Mass., proves otherwise.

What is text editing? How do you use text editing in the classroom? Simply stated, text editing involves using a piece of software to manipulate a line or lines of type you've entered into the computer. You can fiddle with the text until you're satisfied with the way it reads. Today's *word processing* programs are the ultimate in text editing. Indeed, the fancy word processors have overshadowed the use of simple text editors as powerful tools for teaching students.

Text editing in the classroom requires a microcomputer with a display screen, a printer and a text editor program. The text editing program contains commands that allow users to write, change and print text. A simple command statement allows the user to enter line after line of any text — one liners, paragraphs, essays, poems. The only limit is the size of the computer's memory. When the user finishes entering text, he or she uses a second command statement to automatically switch the computer from the text entry to either the text edit or print mode. In the text edit mode, the user can delete, change or insert copy to make any desired changes in any part of the text. Movement within the text is fast.

While more advanced students edit while viewing the screen, novices do best when they edit a printed copy of their text before making changes on the machine. Again, a single command transfers the text from computer to printer for the hard copy the novice editor needs. With experience, this step becomes unnecessary; the student edits on the display screen.

Two elementary classrooms in the Lexington schools have used text editing for the last two years. Our Harrington School offers an excellent example of what can happen when an interested principal (Donald Johnson) selects an interested teacher (Laurie Fales) to introduce a computer innovation.

Terry McKoy

Teacher Laurie Fales helps a student learning to do text editing.

At the time we proposed the text editing program to Mr. Johnson and Ms. Fales for use in Ms. Fales's fifth-grade class, neither of them had either seen or worked with a machine text editor. While they were initially skeptical about how such a system might work in the classroom, they felt that the potential learning outcomes were worth investigating. Ms. Fales, Mr. Johnson and I wrote a funding proposal for a printer to hook up to a school-owned Commodore 8K PET microcomputer. Money in hand, we purchased the printer as well as a text-editing program from Commodore. A high school student-programmer modified the program to our specifications. We installed one of the building-owned PETs in Ms. Fales's classroom, and Beth Lowd, our instructional computing specialist,

taught Ms. Fales and other staff involved with the project how to use the text editor. The stage was set for classroom trial.

Ms. Fales established a computer corner in her classroom. A large, laminated oak tag sign with printed instructions for moving in and out of the three text-editing formats — write, edit and print — was hung at eye level next to the microcomputer. Each student received formal instruction and practice time; those who learned quickly became peer tutors. Ms. Fales provided no typing instruction, but as expected, all students can now machine edit lines of text they've created.

Visitors to Ms. Fales's class today would see students moving to and from the computer corner on a regular basis. Since the class PET uses a cassette storage system, each student has his or her own cassette. A student scheduled to work on the microcomputer retrieves his or her cassette from the storage area, places the cassette in the machine and immediately attacks the assigned lesson. Each student prints out on paper a copy of the completed work, which Ms. Fales can review at her leisure. She writes comments on the print-out with the expectation that the student will follow through during his or her next visit to the computer corner.

What skills are students learning? Start with the following:

- Students *revise* their work. They correct punctuation and carefully select words. They work on sentence structure and juxtapositioning.
- Students learn the art of written expression without the fear of having to produce new copy every time their work is reviewed. This has especially helped students who have a difficult time manipulating a pencil.
- They write longer stories.
- They follow directions.
- They pay attention to detail.

We've had other pleasant surprises as well: a student who had not written a line before being introduced to the text editor sat down and typed 25 lines of text; students from the adjacent classroom now take their turns at the computer corner; our language arts coordinator is creating a set of more formal learning activities to accompany the text editor; and Ms. Fales has become so involved that she's taken a sabbatical for a year of computer studies.

Our text editing program has been so successful that we've expanded it to two additional elementary classrooms, to one junior high and to the high school. While the first two new installations involve only microcomputers, two of the new sites use terminals connected to the school system's PDP 11/40 minicomputer. Since the minicomputer has a very powerful text editor in its operating system, we need no additional software to incorporate it into our program. But more sophisticated software may be in the offing anyway. As more of our elementary-level students gain text editing experience, word processing will be the logical next step in their learning. The question is not, Should text editing be included in the learning process, but, When will word processing be available to the elementary school graduates weaned on text editing systems? □

Dr. Frank DiGiammarino is administrative assistant for planning and research for the Lexington Public Schools, Lexington, Massachusetts.

Computerize Your IEPs

by George A. Hooper

Hardly an administrator or special education teacher has escaped the impact of P.L. 94-142, the Education of All Handicapped Children Act. Particularly burdensome is one of its most time consuming requirements, writing Individual Educational Programs (IPEs). Annually, hundreds of thousands of these IEPs are developed and written out, page after page, by highly trained teachers whose valuable teaching time is used for what amounts to a clerical exercise. While IEPs are certainly valuable, and teachers are essential to the process, there is another way. Let teachers diagnose and prescribe, and let microcomputers print the IEPs.

Up Front Decisions

Before a school district or school embraces the concept of computer-printed IEPs, it must make some basic decisions.

• Mainframe or Micro? A district already heavily invested in a computer terminal system, and a school district with one or more professional programmers on the staff, might well choose to continue using a centralized mainframe system with terminals. However, like a great many school districts, ours did not have the terminals, the professional programmer or the long-term money for either. We started with one Radio Shack Model II computer, with two disk drives and a dot matrix printer (about $6000 total). I was the amateur programmer.

• Is the Curriculum Appropriate? To computerize IEPs, you will have to arrange and number teaching objectives in a sequential manner. We tried sequencing our objectives in two ways. In reading, for example, we arranged objectives in a developmental sequence. In mathematics, we organized objectives first by skill area, then by grade level. Skill areas closely matched those on a frequently used diagnostic test. Both approaches worked. However, if your special education classes assume the entire responsibility for teaching a subject, the reading sequence approach is best. If your approach is supportive and diagnostic, the mathematics approach will better enable you to relate specific test results to specific objectives.

Another curriculum decision is whether to codify and list only terminal objectives or to lay out an entire step-by-step developmental program. We decided on the latter. Specific objectives allow the IEP to become more of a day-to-day teaching document. For programming simplicity and compactness on the IEP, we limited all objectives and their accompanying criteria for mastery to 256 characters and spaces (one record).

• How Personalized an IEP? The computer can print a complete IEP. After administering a test, a teacher can enter the code numbers for test items the student missed, and the computer will generate an IEP. We chose not to do this. Our computer does print an annual goal and pages of specific objectives and mastery criteria, but the teacher fills in the present level of functioning. This handwritten segment helps personalize the IEPs and allows the teacher to turn test results into a meaningful statement for parents.

• Who Will Operate the Program? If you have only one computer to handle the IEP information from various buildings, a secretary will probably handle the task. Although less expensive initially, this approach requires at least one extra form, increased lead time and possibly the ongoing salary of an extra clerk. We used this approach for the first year, but then made the special education teachers responsible for maintaining the IEP files for their pupils. The office staff prints the IEPs. Accordingly, we placed a microcomputer in each school with a special education class. This decreased turn-around time, involved fewer transmittal forms, gave the teacher a closer working knowledge of the IEP and, in the long run, saved money. Finally, if we add a module that suggests materials for each objective, teachers will already be familiar with the program.

Because a number of secretaries, administrators and teachers maintain files and use the computer, we designed the program so that it is easy to use, difficult to misuse and quick to update. To make update and access quick for teachers, the program requires very little typing. In fact, the longest words are generally the pupil's name. Teachers enter four-digit numbers for objectives and similarly use numbers to specify choices and updates.

Passwords make the system difficult to misuse. Any IEP program should require a password. Ours has two. Besides providing a level of security essential for pupil files, this helps prevent major mistakes. The first password provides Level One authorization — complete access to all aspects of the program. Only supervisors familiar with the program use this. The Level Two password allows access to all features of the program but two: the user cannot destroy a pupil file (a teacher can remove a child from the active IEP list, but the child's file remains) and cannot change the master curriculum objectives file. The teachers feel more comfortable knowing that the computer will not let them make a mistake and destroy files.

Program Design

The IEP program, written in BASIC, consists of a main module, an

Administration

objectives file module, a pupil file module, a roster file and an objective conversion module. To save memory, the objective file and objective conversion modules are separate programs "linked" to the main module. That is, the main program calls up and is replaced in memory by the new program.

The Main Module is the heart of the program. It includes the main menu, all IEP routines, class lists and all provisions for maintaining pupil files. As the program begins, screen one identifies the program and requests an access password. With the proper password given, screen two, which is the main menu, appears. Following the selections below, let's run through the program.

•••••

MAIN MENU
DO YOU WISH TO:

[A] CCESS PUPIL FILES
[D] ATA FILES
[P] RINT IEPS
[L] IST STUDENTS ON FILE
[C] ONVERT OLD OBJ. TO NEW OBJ.
[H] ELP

•••••

[A] CCESS PUPIL FILES. Pressing this selection branches the program to the module that handles pupil data. Each student has a separate file that lists IEP objective numbers and the status of these objectives. A pupil file must be developed for each student who is to receive an IEP. Access to the pupil files module brings up the following screen.

•••••

ACCESS PUPIL FILES
DO YOU WISH TO:

[1] SEE PUPIL FILES
[2] BUILD A PUPIL FILE
[3] UPDATE/CHANGE A PUPIL FILE
[4] DELETE A PUPIL FILE
[5] LIST STUDENT NAMES
[6] RETURN TO MAIN MENU

ENTER SELECTION 1-6 THEN HIT ENTER

•••••

Choosing SEE PUPIL FILES either prints on the screen or provides a hard copy of a pupil objectives file. The operator can print one file at a time or can set the computer to print or list automatically all active pupil files.

With the BUILD A PUPIL FILE option, users can create a new student file or add new IEP objectives; with the UPDATE/CHANGE A PUPIL FILE selection, the user enters a pupil's name to bring up the proper file, then enters the number of the objective to be changed and a number for the change, i.e., 1 = change objective from Not Yet Taught to Still Teaching (the computer automatically enters the date). Updating, then, entails simply entering combinations of two numbers. The DELETE A PUPIL FILE option allows the teacher with Level Two password authorization to take a child off the class roster; someone with Level One clearance could delete the file entirely.

Users with Level One authorization can also select the [D] ATA FILES option from the Main Menu. When the data file program is "called up," the Main Module leaves memory. The following choices appear on the screen:

•••••

DATA FILES
DO YOU WISH TO:

[1] PRINT A CATALOG
[2] SEE/UPDATE/DELETE OBJECTIVES
[3] RETURN TO MAIN MENU

ENTER SELECTION 1-3 AND HIT ENTER

•••••

Administration

The PRINT A CATALOG option either displays on the screen or provides a printout of all or part of the IEP catalog, which, by the way, is over 200 pages with over 1800 objectives. Option two, SEE/UPDATE/DELETE OBJECTIVES, allows the user to revise the catalog objective by objective. This is necessary because mastery levels, sequences and other things change from time to time. The RETURN choice merely closes the data files and reloads the Main Module back into memory. Let's return to the Main Menu choices.

[P] RINT IEPS. The program prints both a regular IEP and an evaluation IEP. It also offers an automatic print choice that has the computer go through each pupil's file and print IEPs in all appropriate subject areas. This choice allows the user to leave the machine since the actual printing can take half a day a class for our smaller printers.

To automatically print a regular IEP, the user enters the name of the teacher and the name of the school. The computer then prints the subject area, student name, date, teacher, school, place for the teacher to add a narrative under the Present Level of Functioning heading, annual goal, and specific objectives and criteria for mastery from the student's file. It will print all objectives, regardless of year, that the student has not yet mastered. The prior year's remaining objectives become the first objectives on the new IEP.

We generally use the Evaluation IEP at our spring program review.

Administration

Evaluation IEPs provide parents with a detailed summary of the year's work. An area for teacher comment replaces the Present Level of Functioning section; each specific objective from the regular IEP appears with the addition of three headings: NOT YET TAUGHT, STILL TEACHING, MASTERED AS OF (DATE) . . . PRACTICE TO MAINTAIN. Although the Evaluation IEP generally reports only the current year's progress, it can also track the pupil's progress for all the years he or she has been on file.

The remaining Main Menu choices are: [L] IST PUPILS ON FILE, which lists all students currently on the active roster; [C] ONVERT OLD OBJECTIVE NUMBERS TO NEW OBJECTIVE NUMBERS, a routine that lets us match old and new numbers as we switch from a 13-digit to a four-digit code for each objective; and [H] ELP, which describes Main Menu choices in more detail.

Microcomputers can be an effective aid in printing IEPs for handicapped children. They can also track student progress, complete the proper forms and provide required record-keeping data. But best of all, they can help release teachers from some time-consuming, repetitive tasks. Make use of technology. Computerize your IEPs. □

George A. Hooper is principal of Hopewell Elementary School, Southern Lehigh School District, Center Valley, Pennsylvania.

Media

A Touch of Heresy

by Katharine G. Cipolla

"What'll the librarians do when the computer checks out books?"

Heresy! Words not to be spoken even in private!

But the question was really asked, naively, by a physics teacher who had just been dubbed head of libraries for his system "because he knew about computers." Anyway, to give this heretic his due, he was trying to educate himself in his new field by attending a meeting for library administrators. He really wanted to know. So, the question was asked. The answer was so simple, it sounded flippant: "What they should have been doing all along—teaching!"

Yes, librarians are and always have been teachers. Somewhere over the years, the professional librarian's time became involved with details, like inventory control and, sometimes, babysitting. Look at a catalog of courses for librarianship: Information Management, Theory of Classification, Collections, Development, Bibliographic Instruction... Nowhere will you find How to Write an Overdue Notice or Peace-Keeping Techniques for the Study Hall. So why did such well-prepared information specialists (a.k.a. librarians) get bogged down at the circulation desk?

For one reason, the world at large has never been able to assign a value to information services. How much is the answer to a reference question worth? What is it worth to have students able to locate the information they need? We can figure out how much it costs, but not what it's worth. Administrators and accountants are much happier with circulation statistics (up or down? what percent?) and with fine-money balance sheets—even with book budgets. They can quantify all that; they can even graph it. When all the statistics are collected, no time's left for the librarian's real professional work of locating information or teaching others to locate it.

The age of automation has dawned. Computers are so much better at inventory control, and even at writing overdue notices, than are people. Does that mean that our well-meaning physicist-cum-librarian should lay-off his librarians or assign them to permanent study-hall duty?

Perhaps. Unless he learns to recognize that his librarians, or information specialists as they should be called these days, can do many things that computers can't do at all. Even physicists know about the information explosion. Not one physicist in 20 can find *everything* he or she needs without professional (i.e., an information specialist's) help. Why should he think that the general public can do any better? Life in our culture demands access to information. The one-time rural society that became an industrial culture is now moving into the era of the "knowledge industry," when the majority of people will be manipulating information, not "things." In this culture people can't excel without some access to specialized information. *Librarians know how to find information.*

Teaching library skills is not easy. Neither is teaching reading or calculus. In the culture of the '80s, it is just as crucial. And, who else is equipped to deal with such topics as how to pose a question (so it can be answered), how to deal with information sources, how to develop a search strategy, what information resources are available (printed and computer-based, local, regional and national), how to differentiate between primary, secondary and tertiary sources, or between fact and commentary? These topics should be taught from

Media

the elementary grades on — not begun at the graduate level as is often the case.

Librarians are information specialists. Once liberated from the role of warehouse manager, they can be a wonderful resource. Some suggest that the computer that has assumed circulation duties can also do reference service. Not yet, anyway. The human interface is too great a problem. People just don't ask for what they want the right way. A specialist must translate the public's needs into a form in which they can be researched, either manually or in computer databases. Additionally, dealing with the databases has become a special skill. Databases have unique protocols and individual specialties that make them a study in themselves. A librarian must interpret the question, design the most profitable search and select the most probable information sources, even when the computer is used.

Librarians, like some natural resources, have been squandered in the past. Where they have been given a chance to teach or act as a teaching resource, as they are in many junior colleges and undergraduate colleges, they are in heavy demand. What can a librarian do when the rubber datestamp becomes obsolete? Provide service and instruction to the community whose need for current, correct information is always growing. □

Katharine G. Cipolla is the media services librarian at Barker Library, Massachusetts Institute of Technology, Cambridge.

Reviews

Software

Apple PILOT

Available through authorized Apple dealers. $150.

Apple PILOT — Programmed Inquiry, Learning or Teaching — is a system designed to steer teachers through the morass of program writing, making lessons easy to produce. The system, which runs on an Apple with 48K of memory and dual disk drives, has four components:

1) A "Computer-Assisted Instruction" (CAI) language, PILOT, that has been intentionally designed to help users produce CAI lessons.

2) A graphics utility for producing high resolution graphic images such as pictures, maps, graphs and charts.

3) A sound utility for producing short pieces of music and sound effects.

4) A character set utility that allows users to generate new characters for alternative alphabets (Hebrew, Japanese) or new symbols for maps and charts.

Apple PILOT comes with two manuals: the *Apple PILOT Language Reference Manual* (253 pages), which is an introduction to the Apple version of PILOT, and the *Apple PILOT Editors Reference Manual* (134 pages), which describes the four available editors — the main editor (the "Lesson Test Editor") for the PILOT language itself and an additional editor each for the graphics, sound and character set utilities.

Apple PILOT is programmed in USCD PASCAL and capitalizes on many of the features of this powerful language. The three utilities are well constructed. They are fairly powerful and share many instructions and features, which makes learning to use them much easier than it otherwise might be. I particularly enjoyed working with the "rubber band" cursor control in the Graphics Editor. The user can move the cursor in one of eight directions, stretching a line from the point of origin. A single key stroke transforms the line into a part of the drawing, the diagonal of a frame or the basis for a circle (actually an oval). If the line connects with other lines, the user can fill the shape with colors.

The major accomplishment of Apple PILOT is to combine the utility programs smoothly with PILOT. This is particularly significant for the novice programmer who may not be familiar with the power a good utility provides. Moreover, PILOT afficionados, of which there are many, will be pleased to have a good Apple version.

But Apple PILOT does not do the job it is supposed to do. It does not provide a simple means for teachers who are not already programmers to design effective lessons. It is not a viable substitute for learning to program — even in BASIC.

Apple PILOT is actually far from simple. After all, the two separate manuals total over 400 pages. Moreover, as the authors acknowledge, wading through these manuals is not enough. They are designed for people already familiar with PILOT — the novice must seek additional information before actually constructing lessons. This need to go beyond the manuals is most evident in the lack of sample lessons. The manuals contain only a single complete sample lesson. And while many examples appear throughout the manuals, they demonstrate features of the system, not pedagogy.

This failure to address pedagogy is, I feel, the most severe problem with Apple PILOT. For it is in the area of pedagogy that PILOTs of all sorts, not just Apple's version, take one in the wrong direction. PILOT is designed

Reviews

for a very limited kind of computer-student interaction. The program-designer enters content material into the computer and specifies test questions that the program will ask the student. The designer can add bells, whistles and pictures to interest and "motivate" the student, but the program is still drill and practice. It matches the student's answers against pre-selected possibilities and carries on an "intelligent dialogue" with the student, accepting a close misspelling of the correct answer, suggesting second guesses based on an incorrect first choice. Such a dialogue is extremely difficult to set up, even for the most experienced CAI programmers. It requires a real anticipation of the student's responses. But more important, even when such a dialogue is more of a possibility, as it is with languages promising "smart CAI," it is not necessarily desirable.

PILOT programs vest control in the computer. And with this control, the computer, not the student, accepts the responsibility for learning. The student is a passive recipient of information.

The promise of computer-based education, and the real challenge for the computer-using educator, derives from the possibility of using the computer to create environments in which learning — active learning — is possible.

Teachers needn't be cracker-jack programmers to participate in this vision, but they do need creativity and imagination. It is not an easy task by any means, and it is made much more difficult by relying on a programming language that so tremendously restricts the user.

— **John Richards**

John Richards is with the Division for Study and Research in Education at the Massachusetts Institute of Technology, and is co-editor and publisher of Compuguide, *a computer-based magazine.*

New Products

Product briefs are written from manufacturers' announcements.

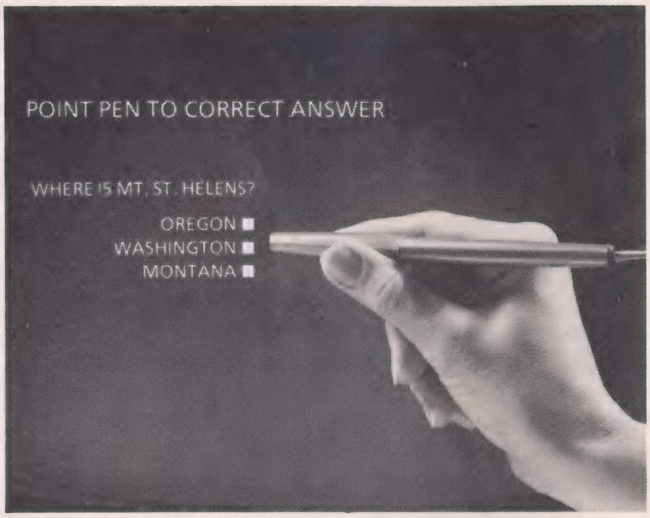
Educational Versions of Digital Software

Digital Research, creator of CP/M and PL/I-80, is now offering educational versions of these software tools to institutions of higher education. The cost is less than one-fifth the usual retail price.

CP/M is the industry standard operating system for eight-bit microcomputers. It is used on more than 300 types of computers, and over 500 vendors write programs under CP/M. PL/I-80 is a microcomputer language developed for easy programming and debugging.

The educational versions, E-CP/M and E-PL/I-80, have extensive documentation that can be used as teaching guides or texts. Both are modified versions of full CP/M and PL/I-80. E-PL/I-80 will operate only with E-CP/M. Both systems cost $25 on orders of 20 or more. One set of manuals is included with every order of 20 systems. Additional manuals may be bought at reduced costs.

For more information, contact Digital Research, P.O. Box 579, 801 Lighthouse Ave., Pacific Grove, CA 93950; 408/649-3896.



The 3G Company, producer of light pens for the PET/CBM and Apple computers, has added a light pen for the TRS-80 Model III to its line. The pen lets the user, adult or child, bypass the keyboard and interact directly with information presented on the screen. It comes with a demonstration game cassette, a sample program and a complete programming book. The 3G Light Pen sells for $39.95, plus postage and handling, and is available from 3G Company or computer stores. For more information, contact 3G Company, Inc., Route 3, P.O. Box 28A, Gaston, OR 97119; 503/662-4492.

Music to Compute By

If you'd like to acquaint your students with the sounds of Scott Joplin, Tchaikovsky or an owl hooting in the night, all produced by computer, you might be interested in a demonstration record now available from Syntauri Corporation.

Syntauri Corporation produces music synthesizer systems based on microcomputer technology. Their new alphaSyntauri synthesizer runs on the Apple II microcomputer and enables musicians — or students — with no computer or programming experience to create computerized music.

The alphaSyntauri system includes the operating system software, instrument definitions, software utilities, a 61-note keyboard, footpedals, a computer interface and Mountain Computer's MusicSystem synthesizer. The entire instrumental system, including the Apple II computer (48K with one disk drive, language card and monitor) sells for under $5000.

For just $2.00, however, you can hear alphaSyntauri music. A demonstration record offers a musical sampler that illustrates the range and styles of music and sound effects the alphaSyntauri can produce. To order, send $2.00 to Syntauri Corporation, 3506 Waverley St., Palo Alto, CA 94306; 415-493-1017.

New Products

New Lesson-Writing System

A new system that enables non-programming teachers to create their own computer-based lessons is now available from Eiconics, Incorporated. Called the *Eureka Learning System*, it guides teachers through the steps of creating computer-assisted instruction lessons that incorporate text and graphics.

The system is available only under a perpetual licensing agreement. The initial license costs $995; $99.50 is added for each additional computer. The license agreement includes a software maintenance contract for the first year of operation. Eiconics will answer questions, repair defects and distribute revisions of the program during that time. Users may buy additional software maintenance for subsequent years. Eiconics also provides training at its New Mexico plant, or, for a price, at the licensee's site. For additional information, contact Eiconics, Inc., 200 Cruz Alta, Taos, NM 87571; 505/758-1696.

Calendar

November

California AEDS Annual Conference. November 19-20. Capitol Plaza Holiday Inn, Sacramento, California. Sponsored by the California Educational Data Processing Association (CEDPA). Will deal with computers and special education, hardware selection, graphics and how to link microcomputers to larger computers. Contact: Marilyn Carson, Santa Clara County Office of Education, 100 Skyport Drive, San Jose, CA 95115; 408/299-2137.

Computers, Productivity and Special Education Administration. November 20. San Francisco State University, San Francisco, California. Sponsored by the National Association of State Directors of Special Education and Learning Tools, Inc. Education and office technology experts will describe computer-based applications in special education management. Contact: Gary Snodgrass, National Association of State Directors of Special Education, 1201 16th Street, N.W., Suite 610E, Washington, D.C. 20036: 202/833-4218.

Microcomputers in Education. November 22-24. Gutman Library, Harvard University, Cambridge, Massachusetts. Sponsored by TERC. Eight workshops, including educational uses of computers, software evaluation, BASIC and graphics, LOGO, PASCAL, and science applications of microcomputers. Contact: Sharon Woodruff, c/o TERC, 8 Eliot St., Cambridge, MA 02138; 617/547-3890.

December

Design and Development of Computer-Based Instructional Materials. December 3-4. Holiday Inn (Long Boat Key), Sarasota, Florida. Discussion of instructional design includes developing a computer-based

Calendar

unit. AEDS workshop. Contact: Peggy Roblyer, ICON enterprises, P.O. Box 13176, Tallahassee, Fl 32308; 904/893-0495.

National Conference of Computer Graphics: Tools for Productivity. December 7-9. International Hotel, San Francisco, California. Includes pre-conference workshop on graphics and video in education and training. Sponsored by *Infosystems Magazine.* Contact: Graphics Dpt., *Infosystems Magazine,* 12611 Davan Drive, Silver Springs, MD 20904; 301/622-0066.

January

Microcomputers in Education. January 15-16. Arizona State University, Tempe, Arizona. Will cover instructional software, LOGO, Pilot, student-written programs, telecommunications, networking and instructional management. Contact: Dr. Gary Bitter, Payne 203, Arizona State University, Tempe, AZ 85287; 602/965-7363.

43rd National Audio-Visual Convention and Exhibit (NAVA/82). January 21-26. Anaheim Convention Center, Anaheim, California. The National Audio-Visual Association (NAVA) convention. New A-V, video and microcomputer products (hardware and software). Contact: NAVA, 3150 Spring St., Fairfax, VA 22031; 703/273-7200.

1982 Joint AAPT/APS Meeting. January 23-28. San Francisco Hilton, San Francisco, California. Sponsored by the American Association of Physics Teachers. Will explore using microcomputers as laboratory instruments, advanced interfacing techniques, introductory PASCAL, writing computer-based lessons. Contact: Tim C. Ingoldsby, AAPT Executive Office, Graduate Physics Building, SUNY-Stony Brook, Stony Brook, NY 11794; 516/246-6840. □

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Letters

Summer Issue

As the principal of a brand new high school with three TRS-80 computers, I felt as if your complimentary issue (Volume 1, Number 6) were a lifeguard who dived in to save a drowning administrator. I need the detailed information your periodical provided.

Robert D. Davies
Mullins Senior High School
Mullins, South Carolina

I received and read the July/August issue of *Classroom Computer News*. This is the best computer information that I've seen recently and I thoroughly enjoyed perusing it. I found it to be dynamic, enterprising, potent, cogent and authoritative.

Wayne Boyer, Ph.D
Armstrong School District
Ford City, Pennsylvania

In the later part of July, I received a sample copy of *Classroom Computer News*, and also a letter offering complimentary copies for programs on computers in education. Since I was offering, for the second year, a three-day workshop on that topic, I placed an order; since the workshop was so near, I realized that the copies could not arrive on time.

My gamble nevertheless paid off. The copies did arrive a few days too late; but that July/August issue looks so valuable that I'm sending a copy to every participant in the workshop.

Victor G. Feser
Mary College
Bismark, North Dakota

I received the July/August issue of *Classroom Computer News* and found virtually no usable direct information for the classroom. I was very disappointed to learn the magazine to be *one giant advertisement*. I receive enough sales propaganda without paying for it. It is really a shame that a good idea has been so polluted. When I read your advertisement, I was hopeful that some first class and up-to-date information for classroom use was finally being published. I really wish I had found it so.

Wilbur G. McCoy
Louisville, Kentucky

My congratulations on your most recent issue of *Classroom Computer News*. The entire issue was one of the best sources of information I have seen to date servicing educational computer users. However, Interpretive Education, producers of MCE microcomputer educational programs, was omitted from your list of educational software vendors.

Allen K. Kemmerer
Interpretive Education
Kalamazoo, Michigan

I'd like to call your attention to an authoring system that was overlooked in your July/August issue ("Author Languages: Instruction Without Programming," by William J. Wagner).

Z.E.S. is a system for the Apple II Plus created in Australia. It is a menu driven system that allows a teacher to create any type of lesson desired. For more information, contact Avant-Garde Creations, P.O. Box 30160, Eugene, OR 97403; 503/345-3043.

Mary Carol Smith
Avant-Garde Creations
Eugene, Oregon

Index of Advertisers

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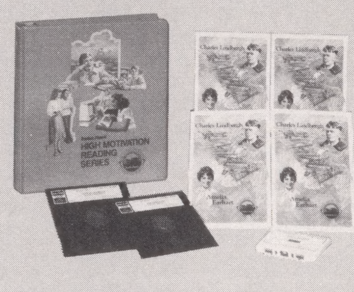

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